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THE

JOURNAL

OF THE

ROYAL AGRICULTURAL SOCIETY

OF ENGLAND.

SECOND SERIES.

VOLUME THE ELEVENTH.

PRACTICE WITH SCIENCE.

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These experiments, it is true, are not easy; still they are in the power of every thinking husbandman. He who accomplishes but one, of however limited application, and takes care to report it faithfully, advances the science, and, consequently, the practice of agriculture, and acquires thereby a right to the gratitude of his fellows, and of those who come after. To make many such is beyond the power of most individuals, and cannot be expected. The first care of all societies formed for the improvement of our science should be to prepare the forms of such experiments, and to distribute the execution of these among their members.

Van Thaer, *Principles of Agriculture.*

London: Printed by William Clowes and Sons, Stamford Street, and Charing Cross.

CONTENTS OF VOLUME XI.

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MAY 1915

APPENDIX.

DIRECTIONS TO THE BINDER.

The Binder is desired to collect together all the Appendix matter, with Roman numeral folios, and place it at the *end* of each volume of the Journal, excepting Titles and Contents, and Statistics &c., which are in all cases to be placed at the *beginning* of the Volume; the lettering at the back to include a statement of the *year* as well as the *volume*: the first volume belonging to 1839-40, the second to 1841, the third to 1842, the fourth to 1843, and so on.

In Reprints of the Journal all Appendix matter and, in one instance, an Article in the body of the Journal (which at the time had become obsolete), were omitted; the Roman numeral folios, however (for convenience of reference), were reprinted without alteration in the Appendix matter retained.

METEOROLOGY; IMPORTATIONS OF GRAIN; SALES OF BRITISH WHEAT; PRICES OF CORN AND OTHER PRODUCE; AGRICULTURAL STATISTICS; AND STATISTICS OF DAIRY PRODUCE.

[*The facts are derived chiefly from the Meteorological Reports of* Mr. Glaisher, *and the Returns of the* Board of Trade, *and of the* Inspector-General of Imports and Exports.]

METEOROLOGY.—1874.

First Quarter (January, February, March).—The warm period which set in on the 15th December, 1873, continued, with very few and slight exceptions, throughout the whole of January and until the 3rd day of February, the average daily excess of mean temperature for these 51 days was 4°·6, and for the 34 days from 1st January was 4°·7; during this lengthened warm period, the direction of the wind was usually a compound of the S. and W. On the 4th of February the wind was N.E., and a cold period began, which continued till the 12th day, the direction of the wind being usually a compound of the E. with N. or S., the average daily deficiency was 6½°.

On the 12th day of February the direction of the wind changed to S.W., and the temperature of the air passed above the average, and continued above for 19 days, its average daily excess was 3°·1; this was followed by 10 days of cold weather, from March 4th to March 13th, and during this period snow fell generally over the country, the average daily deficiency of temperature being 4¼°; from March 13th to the end of the quarter the weather was warm, and the average excess of mean daily temperature was 5¼° nearly.

The mean temperature of January was 41°·7 being 5°·4 higher than the average of 103 years, and 3°·4 higher than the average of the preceding 33 years. It was 0°·4 lower than in 1873, and 0°·4 higher than in 1871, so that the mean temperature for the last 3 consecutive Januaries was 41°·7. Back to 1771 there is only one instance in which the mean temperature of 3 consecutive Januaries has been so high, viz., in the years 1851, 1852, and 1853, when the values were 42°·9, 42°·0, and 42°·4, the mean of which is

42°·4. Since the year 1771 there have been 9 Januaries of somewhat higher temperature than in last January, viz. :—

In the year	1796	it was	45°·3.	In the year	1852	it was	42°·0.
,,	1804	,,	43°·2.	,,	1853	,,	42°·4.
,,	1834	,,	44°·4.	,,	1863	,,	41°·8.
,,	1846	,,	43°·7.	,,	1866	,,	42°·6.
,,	1851	,,	42°·9.				

The mean temperature of February was 38°·7, being 0°·6 lower than the average of the preceding 33 Februaries, 4°·4 warmer than in 1873, and 6°·1 colder than in 1872.

The mean temperature of March was 43°·7, being 2¾° higher than the average of 103 years, and 2°·1 higher than that of the preceding 33 years; higher than in 1873 by 1°·8, but lower than in 1872 by 0°·9. The month of March was warm, but back to 1771 the mean temperature has been exceeded 21 times.

The mean temperature of the quarter was 41°·4, the average temperature for the first 3 months of the year as found from the previous 103 years was 38°·7, and as found from the preceding 33 years 39°·8; the excess of temperature for the quarter over the former is 2°·7, and over the latter is 1°·6.

The fall of rain in January was one inch, being only about one-half of the average, in February it was 0·94 inches, being about two-thirds of the average, and in March it was 0·45 inches only, being less than one-third of the average.

Second Quarter (April, May, June).—The warm period which set in on 13th March (the excess of the daily temperature of which over daily averages till the end of March was 5¼°) continued with very slight exceptions throughout April, the average daily excess of temperature for this month being 4°. On several days towards the end of the month the days were very warm, the excesses being as large as 10° to 13°. On 1st May a cold period set in, and continued without exception till the 21st; these three weeks of low temperature were very painful, following so immediately the heat of the preceding seven weeks. A period of warm weather then occurred from 22nd May to 11th June, the average daily excess of temperature being 4½°, and from this time to the end of the quarter low temperatures prevailed, the deficiency of daily temperature amounting to nearly 4½°.

The mean temperature of April was 50°·0, being 4°·0 higher than the average of 103 years, and 2°·9 higher than that of the preceding 33 years. It was higher than in 1873 by 4°·1, and higher than in 1872 by 1°·7.

Going back to the year 1771, there have been but five Aprils of so high a temperature as in 1874, viz. :—

The year 1779 when the mean temperature of April was			50°·7.
,, 1821	,,	,,	50°·4.
,, 1844	,,	,,	51°·7.
,, 1865	,,	,,	52°·3.
,, 1869	,,	,,	50°·3.

The mean temperature of May was 50°·5, being 2°·0 lower than the average of 103 years, and 2°·4 lower than that of the preceding 33 years; it was 0°·1 and 0°·4 colder than in 1873 and 1872 respectively.

The mean temperature of June was 58°·0, being respectively 0°·2 and 1°·0 lower than the average of 103 years, and the preceding 33 years; it was 0°·9 below the corresponding value for 1873, and 1°·2 below that of 1872.

The mean temperature of the quarter was 52°·8, the average temperature for the second 3 months of the year as deduced from the previous 103 years was 52°·2, and as deduced from the preceding 33 years 53°·0; showing that the excess of temperature for the quarter over the former was 0°·6, and the defect below the latter 0°·2.

The fall of rain in April was 1·4 inch, being 0·3 inch below the average, in May it was 0·4 inch only, and in June it was 2·4 inches, being 0·5 inch above the average.

This continued deficiency of rain was very remarkable, and was general over the whole country.

In the 4 months ending April, there is only one instance, back to the year 1815, of a smaller fall than in this year, viz., in 1854, when the amount was 3·5 inches.

In flower—

	The earliest.	The latest.
Wheat,	June 7, at Weybridge Heath;	June 26, at Hull.

In ear—

Wheat,	June 6, at Strathfield Turgiss;	June 15, at Cockermouth.
Barley,	June 4, at Helston;	June 24, at Cockermouth.
Oats,	June 8, at Helston;	June 25, at Cockermouth.

Third Quarter (July, August, September).—The cold weather which prevailed during the last three weeks of June was succeeded at the beginning of July by weather which was generally warm, but frequently cold; the average daily excess over the average daily temperature till the 2nd August was 2½°. A period of moderately cold weather followed, and the daily temperatures were, with the exception of a few warm days, below their averages till the 19th day of September, the average daily deficiency for the 48 days ending 19th September was 1°: from the 20th of September the weather was warm till the end of the quarter, the average daily excess being as large as 5°. The mean temperature of July was 6°·4 higher than in June; that of August was 4°1 lower than in July; and that of September was 2°·4 below that of August.

(From the preceding 33 years' observations the mean temperature of July was higher than that of June by 3°·2; that of August was 0°·8 lower than July; and September 4°·2 lower than in August.)

The mean temperature of July above that of June over the whole country was 6°·0; that of August below that of July was 3°·8; and that of September below August was 2°·2. The mean temperature of July over that of June was largest in the Midland Counties, and was smallest both at extreme Northern and Southern stations. The decrease from July to August and from August to September was nearly the same at all places.

The mean temperature of the air for July was 64°·4, being respectively 2°·8 and 2°·2 higher than the averages of 103 years, and the preceding 33 years; it was 1°·0 higher than that of 1873, and 0°·6 lower than that of 1872.

The mean temperature of August was 60°·3, being 0°·5 lower than the average of 103 years, and 1°·1 lower than that of the preceding 33 years; it was respectively 2°·4 and 0°·7 lower than the corresponding values in 1873 and 1872.

The mean temperature of September was 57°·9, being respectively 1°·4 and 0°·7 higher than the averages of 103 years, and the preceding 33 years; and 3°·2 and 0°·5 respectively higher than those recorded in the month of September in the years 1873 and 1872.

The fall of rain in July was 2°·6 inches, being 0·1 inch above the average; in August it was 1·4 inch, being 1·0 inch below the average; and in September it was 2·2 inches, being 0·2 inch below the average.

The fall of rain, therefore, continued to be remarkably deficient.

Wheat was cut, on the 16th of July at Brighton; on the 17th at Guernsey; on the 18th at Osborne and Streatley; on the 22nd at Weybridge Heath; on the 23rd at Cardington; on the 27th at Hastings; and on the 29th at Helston. On the 1st of August at Llandudno; on the 3rd at Silloth; on the 10th at North Shields; on the 11th at Calcethorpe; and on the 12th at Bywell.

Barley was cut, on the 24th of July at Weybridge Heath; and on the 31st at North Shields. On the 3rd of August at Helston; on the 6th at Bywell; on the 7th at Llandudno; and on the 18th at Calcethorpe.

Oats were cut, on the 14th of July at Brighton; and on the 21st at Weybridge Heath. On the 3rd of August at Llandudno; on the 4th at Helston; on the 6th at Bywell; and on the 10th at Calcethorpe.

Fourth Quarter (October, November, December).—The warm period which began on the 20th September ended on 1st October, and was followed by eight days of cold weather; the deficiency of daily mean temperature was on the average 4°. From 10th October to 20th November the weather was warm, with the exception of the few days from 20th October to 24th October, and from 11th

November to 14th November, which were cold. The average daily temperature of the 42 days ending 20th November was 49°·1, exceeding the average by 2°·4. The excess over the average on some days was as large as 8° or 9°. On 21st November a severe cold period set in, and continued with very slight exceptions till 1st January, 1875; the average daily temperature of the 42 days ending on this day was 33°·5, being 6°·6 below the average. The temperature on several days was more than 10° in defect; on the 10th and 22nd December it was about 12°; on 23rd December it was $14\frac{1}{4}$°; on 29th December, $12\frac{1}{2}$°; on 30th December, $12\frac{3}{4}$°; and on the last day of the year it was as large as $16\frac{1}{2}$° nearly. On this day the mean temperature was 21°·1 only; the day was painfully cold.

Of remarkable low mean daily temperature there have been 28 since the year 1814, eleven only in the last 30 years, five in January, two in February, and four in December; of these 11 instances, three took place in January and February 1855. During that remarkable cold period extending from 14th January to the 27th February the mean temperature of these 42 days was 29°·0, and, therefore, was much colder than in the recent period; the departure of these 42 days was $9\frac{3}{4}$° nearly, below the average. There was another analogous period of 42 days' cold, extending from 21st December, 1870, to 31st January, 1871; the mean temperature of this period was 31°·1, or 6° below the average.

Since the year 1771, the following are all the instances of so low a mean temperature in December as 33°·2. In the year—

1784	it was	31°·0	1799	it was	32°·8	1846	it was	32°·9
1788	„	29°·0	1840	„	33·°3	1874	„	33°·2
1796	„	30°·4	1844	„	33°·0			

The mean temperature of November and December taken together was 37°·6; since the year 1829, when the mean temperature of these two months was 37°·1, there has been only one instance of so low a mean temperature as in this year, viz., in 1870, when it was 37°·55.

The mean temperature of October was 51°·7, being respectively 2°·1 and 1°·5 higher than the averages of 103 years, and the preceding 33 years; it was 3°·9 higher than that of 1873 and 1872 respectively.

The mean temperature of November was 42°·0, being 0°·3 lower than the average of 103 years, and 1°·6 lower than that of the preceding 33 years; and 1°·2 and 3°·3 respectively lower than those recorded in the month of November in the years 1873 and 1872.

The mean temperature of December was 33°·2, being 5°·9 and 7°·1 respectively lower than the averages of 103 years, and the preceding 33 years; it was 7°·4 and 9°·7 lower than the corresponding value in 1873 and 1872.

The fall of rain in the three months was 7·2 inches, making 20·0 inches in the year, being 5·4 inches below the average annual fall.

Meteorological Observations recorded at the Royal Observatory, Greenwich, in the First Six Months of the Year 1874.

1874. Months.	Temperature of Air. Mean.	Air. Diff. from average of 103 years.	Air. Diff. from average of 33 years.	Evaporation. Mean.	Evaporation. Diff. from average of 33 years.	Dew Point. Mean.	Dew Point. Diff. from average of 33 years.	Air—Daily Range. Mean.	Air—Daily Range. Diff. from average of 33 years.	Water of the Thames.	Elastic Force of Vapour. Mean.	Elastic Force of Vapour. Diff. from average of 33 years.	Weight of Vapour in a Cubic Foot of Air. Mean.	Weight of Vapour. Diff. from average of 33 years.
	°	°	°	°	°	°	°	°	°	°	in.	in.	grs.	grs.
January ..	41·7	+5·4	+3·4	40·0	+3·1	37·9	+2·9	11·1	+1·5	41·0	0·228	+0·025	2·6	+0·2
February ..	38·7	+0·1	−0·6	36·8	−0·8	34·2	−0·9	11·5	+0·2	40·3	0·197	−0·009	2·3	+0·1
March ..	43·7	+2·7	+2·1	41·2	+1·9	38·2	+1·8	16·2	+1·5	43·8	0·231	+0·015	2·7	+0·2
Means ..	41·4	+2·7	+1·6	39·3	+1·4	36·8	+1·3	12·9	+1·1	41·7	0·219	+0·010	2·5	+0·2
	°	°	°	°	°	°	°	°	°	°	in.	in.	grs.	grs.
April	50·0	+4·0	+2·9	46·9	+2·9	43·6	+3·0	20·3	+1·7	50·5	0·284	+0·030	3·3	+0·4
May	50·5	−2·0	−2·4	46·7	−2·4	42·8	−2·6	22·5	+2·0	54·9	0·275	−0·027	3·2	−0·2
June	58·0	−0·2	−1·0	53·5	−1·1	49·5	−1·2	22·8	+1·8	62·5	0·355	−0·016	3·9	−0·3
Means ..	52·8	+0·6	−0·2	49·0	−0·2	45·3	−0·3	21·9	+1·8	56·0	0·305	−0·004	3·5	0·0

Note.—In reading this Table it will be borne in mind that the sign (−) *minus* signifies *below* the average, and that the sign (+) *plus* signifies *above* the average.

METEOROLOGICAL OBSERVATIONS RECORDED AT THE ROYAL OBSERVATORY, GREENWICH, IN THE FIRST SIX MONTHS OF THE YEAR 1874.

1874. MONTHS.	Degree of Humidity.		Reading of Barometer.		Weight of a Cubic Foot of Air.		Rain.		Daily Horizontal movement of the Air.	Reading of Thermometer on Grass.				
										Number of Nights it was				
	Mean.	Diff. from average of 33 years.	Mean.	Diff. from average of 33 years.	Mean.	Diff. from average of 33 years.	Amount.	Diff. from average of 59 years.		At or below 30°.	Between 30° and 40°.	Above 40°.	Lowest Reading at Night.	Highest Reading at Night.
			In.	In.	grs.	grs.	In.	In.	Miles.				°	°
January ..	87	− 1	29·891	+0·156	552	− 1	1·0	−0·9	334	16	12	3	19·0	42·0
February ..	85	0	29·852	+0·056	555	+ 2	0·9	−0·6	261	18	8	2	14·3	44·7
March ..	81	− 1	30·013	+0·271	552	+ 2	0·5	−1·1	339	14	12	5	15·0	46·8
							Sum	Sum	Mean	Sum	Sum	Sum	Lowest	Highest
Means ..	84	− 1	29·919	+0·161	553	+ 1	2·4	−2·6	311	48	32	10	14·3	46·8
			In.	In.	grs.	grs.	In.	In.	Miles				°	°
April ..	79	0	29·704	−0·066	539	− 4	1·4	−0·3	306	6	20	4	22·3	47·0
May	76	0	29·803	+0·023	541	0	0·4	−1·7	226	15	9	7	20·2	51·2
June ..	74	0	29·939	+0·128	535	+ 3	2·4	+0·5	247	1	13	16	26·9	55·0
							Sum	Sum	Mean	Sum	Sum	Sum	Lowest	Highest
Means ..	76	0	29·815	+0·028	538	0	4·2	−1·5	260	22	42	27	20·2	55·0

NOTE.—In reading this Table it will be borne in mind that the sign (−) *minus* signifies *below* the average, and that the sign (+) *plus* signifies *above* the average.

METEOROLOGICAL OBSERVATIONS RECORDED AT THE ROYAL OBSERVATORY, GREENWICH, IN THE LAST SIX MONTHS OF THE YEAR 1874.

1874. MONTHS.	Temperature of Air. Mean.	Air. Diff. from average of 103 years.	Air. Diff. from average of 33 years.	Evaporation. Mean.	Evaporation. Diff. from average of 33 years.	Dew Point. Mean.	Dew Point. Diff. from average of 33 years.	Air—Daily Range. Mean.	Air—Daily Range. Diff. from average of 33 years.	Water of the Thames.	Elastic Force of Vapour. Mean.	Elastic Force of Vapour. Diff. from average of 33 years.	Weight of a Vapour in Cubic Foot of Air. Mean.	Weight of a Vapour in Cubic Foot of Air. Diff. from average of 33 years.
	°	°	°	°	°	°	°	°	°	°	in.	in.	grs.	grs.
July	64·4	+2·8	+2·2	59·0	+1·3	54·6	+0·7	25·4	+4·3	67·0	0·427	+0·010	4·7	+0·1
August ..	60·3	−0·5	−1·1	56·6	−0·7	53·3	−0·5	20·6	+0·8	64·0	0·407	−0·009	4·5	−0·1
September	57·9	+1·4	+0·7	55·4	+1·4	53·1	+2·1	18·1	−0·4	60·5	0·404	+0·025	4·5	+0·3
Means ..	60·9	+1·2	+0·6	57·0	+0·7	53·7	+0·8	21·4	+1·6	63·8	0·413	+0·009	4·6	+0·1
	°	°	°	°	°	°	°	°	°	°	in.	in.	grs.	grs.
October ..	51·7	+2·1	+1·5	50·2	+2·0	48·7	+2·6	13·8	−1·1	54·9	0·344	+0·031	3·9	+0·3
November ..	42·0	−0·3	−1·6	40·3	−1·1	38·3	−1·3	11·8	+0·1	47·5	0·231	−0·017	2·7	−0·1
December ..	33·2	−5·9	−7·1	32·1	−6·7	29·9	−7·1	9·3	−0·2	35·7	0·166	−0·056	2·0	−0·6
Means ..	42·3	−1·4	−2·4	40·9	−1·9	39·0	−1·9	11·6	−0·4	46·0	0·247	−0·014	2·9	−0·1

NOTE.—In reading this Table it will be borne in mind that the sign (−) *minus* signifies *below* the average, and that the sign (+) *plus* signifies *above* the average.

METEOROLOGICAL OBSERVATIONS RECORDED AT THE ROYAL OBSERVATORY, GREENWICH, IN THE LAST SIX MONTHS OF THE YEAR 1874.

1874. MONTHS.	Degree of Humidity.		Reading of Barometer.		Weight of a Cubic Foot of Air.		Rain.		Daily Horizontal movement of the Air.	Reading of Thermometer on Grass.				
										Number of Nights it was			Lowest Reading at Night.	Highest Reading at Night.
	Mean.	Diff. from average of 33 years.	Mean.	Diff. from average of 33 years.	Mean.	Diff. from average of 33 years.	Amount.	Diff. from average of 59 years.		At or below 30°.	Between 30° and 40°.	Above 40°.		
			in.	in.	grs.	grs.	in.	in.	Miles.				°	°
July	70	− 5	29·826	+0·025	526	− 2	2·6	+0·1	220	0	4	27	37·0	58·0
August ..	78	+ 2	29·783	−0·010	530	+ 1	1·4	−1·0	301	0	5	26	33·9	54·6
September	84	+ 4	29·752	−0·055	531	− 2	2·2	−0·2	259	0	8	22	34·7	54·0
							Sum	Sum	Mean	Sum	Sum	Sum	Lowest	Highest
Means ..	77	0	29·787	−0·013	529	− 1	6·2	−1·1	260	0	17	75	33·9	58·0
			in.	in.	grs.	grs.	in.	in.	Miles				°	°
October ..	90	+ 3	29·708	+0·009	537	− 2	3·6	+0·9	293	5	12	14	27·7	51·9
November	87	− 1	29·779	+0·025	550	+ 2	1·9	−0·4	259	16	11	3	18·3	44·9
December	88	0	29·612	−0·194	557	+ 5	1·7	−0·3	285	25	6	0	12·0	32·0
							Sum	Sum	Mean	Sum	Sum	Sum	Lowest	Highest
Means ..	88	+ 1	29·700	−0·053	548	+ 2	7·2	+0·2	279	46	29	17	12·0	51·9

NOTE.—In reading this Table it will be borne in mind that the sign (−) *minus* signifies *below* the average, and that the sign (+) *plus* signifies *above* the average.

CORN: Importations, Sales, and Prices.

Quantities of Wheat, Wheatmeal and Flour, Barley, Oats, Peas and Beans, Imported into the United Kingdom in the Year 1874.

1874.	Wheat.	Wheatmeal and Flour.	Barley.	Oats.	Peas.	Beans.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
January ..	3,685,175	662,420	748,396	809,317	50,130	199,715
February	3,523,554	762,226	1,036,246	1,044,298	110,337	290,392
March ..	3,082,485	594,005	613,515	700,557	114,355	251,337
April ..	2,561,132	507,767	960,570	827,267	123,746	158,347
May ..	2,282,145	418,008	739,623	1,036,830	162,109	120,748
June ..	3,953,833	574,227	551,300	1,367,552	158,934	198,157
In first Six Months	19,088,324	3,518,653	4,649,650	5,785,821	719,611	1,218,696
July	4,683,232	598,013	437,968	971,707	317,675	153,546
August ..	3,819,777	355,927	384,656	1,269,292	91,728	135,321
September	4,144,321	394,786	1,458,504	813,874	45,333	155,025
October ..	3,758,934	474,790	2,030,204	609,491	61,103	327,430
November	3,613,778	406,693	1,120,632	930,956	241,933	200,640
December	2,371,094	480,746	1,298,122	1,014,869	331,597	172,493
In last Six Months	22,391,136	2,710,955	6,730,086	5,610,189	1,089,369	1,144,455
Year ..	41,479,460	6,229,608	11,379,736	11,396,010	1,808,980	2,363,151

Note.—The average weights *per quarter* of corn, as adopted in the office of the Inspector-General of Imports and Exports, are as follow:—For wheat, 485⅓ lbs., or 4⅓ cwts.; for barley, 400 lbs., or 3⁴⁄₇ cwts.; for oats, 308 lbs., or 2¾ cwts. Corn has been entered and charged with duty by *weight* instead of *measure* since September, 1864.

Computed Real Value of Corn Imported into the United Kingdom in each of the Five Years, 1870-74.

	1870.	1871.	1872.	1873.	1874.
	£.	£.	£.	£.	£.
Wheat	16,264,027	23,345,630	26,046,876	28,446,689	25,201,062
Barley	2,831,844	3,407,425	6,194,155	4,010,344	5,266,096
Oats	4,381,607	4,141,687	4,212,086	4,804,118	5,118,785
Maize	5,790,550	6,470,789	8,696,362	6,621,720	7,484,178
Other kinds	1,498,043	1,729,048	1,747,073	1,788,716	1,959,237
Wheat Flour	3,383,751	3,502,784	4,092,189	5,839,197	5,709,820
Other kinds of Flour	19,822	10,712	9,883	10,570	14,405
Total of Corn ..	34,169,644	42,403,575	50,998,624	51,521,354	50,753,583

QUANTITIES of BRITISH WHEAT SOLD in the Towns from which Returns are received under the Act of the 27th & 28th VICTORIA, cap. 87, and their AVERAGE PRICES, in each of the TWELVE MONTHS of the YEARS 1869-74.

	Quantities in Quarters.					
	1869.	1870.	1871.	1872.	1873.	1874.
	quarters.	quarters.	quarters.	quarters.	quarters.	quarters.
First month ..	248,047	187,027	267,827	194,719	183,987	187,106
Second month	258,883	231,428	309,376	193,910	202,977	189,031
Third month (five weeks)	278,086	314,040	377,003	245,612	238,125	206,145
Fourth month	204,519	242,457	293,494	191,522	159,268	150,725
Fifth month ..	238,483	281,620	222,003	231,780	225,595	175,715
Sixth month (five weeks)	268,599	296,028	229,749	268,626	219,750	172,298
Seventh month	166,485	171,005	120,154	109,543	101,101	95,871
Eighth month	174,904	201,788	123,889	126,769	96,986	82,564
Ninth month (five weeks)	255,286	435,398	371,590	295,774	266,856	323,153
Tenth month	256,984	340,445	367,672	264,934	265,122	248,984
Eleventh month	220,876	298,407	269,351	195,743	214,026	225,162
Twelfth month (five weeks)	244,933	352,629	322,756	263,152	285,648	335,339

	Average Prices per Quarter.					
	1869.	1870.	1871.	1872.	1873.	1874.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
First Month ..	51 10	43 11	52 8	55 4	55 10	62 4
Second month	50 10	41 10	53 6	55 8	56 5	63 4
Third month (five weeks)	48 5	41 3	54 6	55 1	55 6	61 1
Fourth month	46 4	42 7	58 2	54 2	54 10	60 0
Fifth month ..	44 8	43 10	59 1	56 3	55 8	62 2
Sixth month (five weeks)	45 10	47 0	59 8	58 11	58 4	61 2
Seventh month	49 5	50 9	58 7	58 7	59 6	60 8
Eighth month	52 1	53 11	57 11	59 9	60 1	58 4
Ninth month (five weeks)	51 4	47 0	57 0	58 7	63 10	48 11
Tenth month ..	47 8	47 4	56 5	58 7	60 10	44 8
Eleventh month	46 8	50 1	56 2	56 11	60 9	43 11
Twelfth month (five weeks)	44 2	52 4	56 2	56 7	61 6	44 6

Average Prices of British Corn per Quarter (Imperial measure) as received from the Inspectors and Officers of Excise according to the Act of 27th & 28th Victoria, cap. 87, in each of the Fifty-two Weeks of the Year 1874.

Week ending	Wheat.		Barley.		Oats.		Week ending	Wheat.		Barley.		Oats.	
	s.	d.	s.	d.	s.	d.		s.	d.	s.	d.	s.	d.
January 3..	61	8	44	4	25	5	July 4..	60	8	41	11	30	10
January 10..	62	1	43	11	26	1	July 11..	60	9	41	7	29	11
January 17..	62	6	46	2	27	2	July 18..	60	10	39	6	31	2
January 24..	63	3	46	5	27	10	July 25..	60	5	40	1	29	8
January 31..	63	9	47	7	28	2	August 1..	59	8	46	1	30	9
February 7..	63	9	48	9	28	3	August 8..	58	6	39	1	30	8
February 14..	63	2	48	9	28	1	August 15..	58	0	45	0	30	6
February 21..	62	10	49	1	28	10	August 22..	57	2	46	5	32	0
February 28..	62	1	49	3	29	4	August 29	54	6	45	11	30	4
March 7..	61	6	48	5	28	11	September 5	49	9	44	0	29	2
March 14..	60	8	48	4	28	10	September 12	47	2	43	2	28	6
March 21..	60	7	48	1	28	3	September 19	46	8	42	5	27	2
March 28..	60	10	48	6	28	7	September 26	46	9	41	11	27	9
Average of Winter Quarter	62	2	47	6	27	11	Average of Summer Quarter	55	5	42	10	29	10
April 4..	60	3	48	9	28	2	October 3..	46	1	42	4	27	4
April 11..	59	5	48	8	28	3	October 10..	44	8	42	7	27	11
April 18..	60	6	48	5	28	7	October 17..	43	10	42	8	27	2
April 25..	60	0	49	11	28	11	October 24..	44	1	42	10	27	9
May 2..	62	1	46	6	29	1	October 31	44	1	42	11	27	11
May 9..	62	2	47	3	30	10	November 7	44	5	42	8	27	11
May 16..	62	1	47	5	29	2	November 14	43	9	42	7	28	0
May 23..	62	4	45	11	30	1	November 21	43	5	42	6	27	11
May 30..	62	2	47	8	29	1	November 28	43	6	42	10	27	11
June 6..	61	8	45	8	29	11	December 5	44	8	43	8	28	7
June 13..	61	4	41	5	30	0	December 12	44	10	44	3	28	10
June 20..	60	8	42	0	30	4	December 19	45	1	44	7	29	8
June 27..	60	4	42	2	31	2	December 26	44	8	44	5	29	4
Average of Spring Quarter	61	1	46	3	29	6	Average of Autumn Quarter	44	4	43	1	28	2

QUANTITIES of WHEAT, BARLEY, OATS, PEAS, BEANS, INDIAN CORN or MAIZE, WHEATMEAL and FLOUR, IMPORTED in the FOUR YEARS 1871–74; also the COUNTRIES from which the WHEAT, WHEATMEAL, and FLOUR were obtained.

	1871.	1872.	1873.	1874.
Wheat from—	cwts.	cwts.	cwts.	cwts.
Russia	15,629,435	17,840,640	9,598,096	5,714,488
Denmark	130,370	431,176	301,758	167,286
Germany	3,049,031	3,887,746	2,153,857	3,053,680
France	134,841	2,843,016	1,170,522	300,299
Austrian Territories	239,147	54,732	29,730	2,814
Turkey and Wallachia and Moldavia	1,418,886	838,073	367,487	659,676
Egypt	884,396	2,337,208	1,260,401	293,880
United States	13,405,057	8,606,403	19,742,726	23,048,552
Chili	549,529	1,434,125	1,557,128	1,925,334
British North America ..	3,279,264	1,719,378	3,767,330	3,807,174
Other countries	687,690	1,997,731	3,802,595	2,506,277
Total Wheat ..	39,407,646	41,990,228	43,751,630	41,479,460
Barley	8,589,059	15,078,140	9,232,485	11,379,736
Oats	11,007,106	11,567,058	11,922,736	11,396,010
Peas	1,021,950	1,290,076	1,211,068	1,808,980
Beans	2,975,651	2,937,514	2,976,500	2,363,151
Indian Corn, or Maize	16,832,499	24,563,334	18,768,127	17,683,212
Wheatmeal and Flour from—				
Germany	967,892	1,054,574	687,243	751,366
France	37,150	1,341,465	1,669,356	659,568
United States..	1,794,805	743,412	1,580,697	3,290,235
British North America.. ..	403,989	339,300	444,729	389,355
Other countries	780,802	917,308	1,822,235	1,139,084
Total Wheatmeal and Flour	3,984,638	4,396,059	6,204,260	6,229,608
Indian Corn Meal	7,881	5,384	6,836	8,511

The Average Prices of Consols, of Wheat, of Meat, and of Potatoes; also the Average Number of Paupers relieved on the *last day* of each Week; and the Mean Temperature, in each of the Twelve Quarters ending December 31st, 1874.

Quarters ending	Average Prices.						Pauperism.		Mean
	Consols (for Money).	Minimum Rate per Cent. of Discount charged by the Bank of England.	Wheat per Quarter in England and Wales.	Meat per lb. at the Metropolitan Meat Market (by the Carcase).		Potatoes (York Regents) per Ton, at Waterside Market, Southwark.	Quarterly Average of the Number of Paupers relieved on the *last day* of each week.		Tempe rature
				Beef.	Mutton.		In-door.	Out-door.	
1872	£.		*s.* *d.*						o
Mar. 31	$92\frac{4}{8}$	3·0	55 4	$5d.$—$7\frac{1}{4}d.$ Mean $6\frac{1}{8}d.$	$5\frac{3}{4}d.$—$8\frac{1}{2}d.$ Mean $7\frac{1}{8}d.$	80*s.*—120*s.* Mean 100*s.*	149,599	776,793	43·6
June 30	$92\frac{7}{8}$	4·0	56 8	$5\frac{1}{4}d.$—$7\frac{1}{2}d.$ Mean $6\frac{3}{8}d.$	$6d.$—$8\frac{3}{4}d.$ Mean $7\frac{3}{8}d.$	124*s.*—150*s.* Mean 137*s.*	134,412	724,463	52·8
Sept. 30	$92\frac{4}{8}$	3·5	58 11	$5\frac{1}{4}d.$—$8d.$ Mean $6\frac{5}{8}d.$	$6\frac{1}{4}d.$—$9\frac{1}{4}d.$ Mean $7\frac{3}{4}d.$	105*s.*—133*s.* Mean 119*s.*	126,377	681,987	61·1
Dec. 31	$92\frac{2}{8}$	5·9	57 3	$5\frac{1}{2}d.$—$8d.$ Mean $6\frac{3}{4}d.$	$6d.$—$8\frac{1}{2}d.$ Mean $7\frac{1}{4}d.$	154*s.*—187*s.* Mean 171*s.*	138,648	675,598	45·
1873									
Mar. 31	$92\frac{3}{8}$	3·9	55 10	$5\frac{1}{2}d.$—$8d.$ Mean $6\frac{3}{4}d.$	$6\frac{1}{4}d.$—$9d.$ Mean $7\frac{5}{8}d.$	179*s.*—235*s.* Mean 207*s.*	150,392	703,357	39·
June 30	$93\frac{3}{8}$	5·2	56 5	$6d.$—$8\frac{3}{4}d.$ Mean $7\frac{3}{8}d.$	$6\frac{3}{4}d.$—$9\frac{1}{2}d.$ Mean $8\frac{1}{8}d.$	183*s.*—242*s.* Mean 212*s.* 6*d.*	135,491	666,126	51·
Sept. 30	$92\frac{4}{8}$	3·8	61 4	$5\frac{3}{4}d.$—$8\frac{3}{4}d.$ Mean $7\frac{1}{4}d.$	$6\frac{1}{2}d.$—$9\frac{1}{4}d.$ Mean $7\frac{7}{8}d.$	95*s.*—120*s.* Mean 107*s.* 6*d.*	127,674	632,412	60·
Dec. 31	$92\frac{4}{8}$	6·3	61 1	$5d.$—$8\frac{1}{2}d.$ Mean $6\frac{3}{4}d.$	$5\frac{3}{4}d.$—$8\frac{1}{2}d.$ Mean $7\frac{1}{8}d.$	{ 96*s.* 6*d.*— 117*s.* 6*d.* } Mean 107*s.*	137,409	625,316	44·
1874									
Mar. 31	92	3·6	62 2	$5\frac{1}{4}d.$—$8\frac{1}{4}d.$ Mean $6\frac{3}{4}d.$	$5\frac{1}{2}d.$—$8\frac{1}{4}d.$ Mean $6\frac{7}{8}d.$	112*s.*—127*s.* Mean 119*s.* 6*d.*	146,082	641,910	41·
June 30	93	3·4	61 1	$5d.$—$8d.$ Mean $6\frac{1}{2}d.$	$5d.$—$8\frac{1}{4}d.$ Mean $6\frac{5}{8}d.$	135*s.*—165*s.* Mean 150*s.*	133,846	614,738	52·
Sept. 30	$92\frac{5}{8}$	3·0	55 5	$5\frac{1}{4}d.$—$8d.$ Mean $6\frac{5}{8}d.$	$5\frac{1}{4}d.$—$7\frac{3}{4}d.$ Mean $6\frac{1}{2}d.$	{ 75*s.* 6*d.*— 104*s.* 6*d.* } Mean 90*s.*	129,996	592,958	60·
Dec. 31	93	4·7	44 4	$4\frac{7}{8}d.$—$8\frac{1}{4}d.$ Mean $6\frac{1}{2}d.$	$4\frac{3}{4}d.$—$8d.$ Mean $6\frac{1}{4}d.$	73*s.*—96*s.* Mean 84*s.* 6*d.*	138,899	587,776	42

The annexed return shows the number of Beasts exhibited and the priees realised for them at the Christmas markets since 1841 :—

Year.	Beasts.	*s.* *d.* *s.* *d.*	Year.	Beasts.	*s.* *d.* *s.* *d.*
1841	4,500	3 8—5 0	1858	6,424	3 4—5 0
1842	4,541	3 4—4 8	1859	7,560	3 6—5 4
1843	4,510	4 8—4 4	1860	7,860	3 4—5 6
1844	5,713	4 0—4 6	1861	8,840	3 4—5 0
1845	5,326	3 6—4 8	1862	8,430	3 4—5 0
1846	4,570	4 0—5 8	1863	10,372	3 6—5 2
1847	4,282	3 4—4 8	1864	7,130	3 8—5 8
1848	5,942	3 4—4 8	1865	7,530	3 4—5 4
1849	5,765	3 4—4 0	1866	7,340	3 8—5 6
1850	6,341	3 0—3 10	1867	8,110	3 4—5 0
1851	6,103	2 8—4 2	1868	5,320	3 4—5 8
1852	6,271	2 8—4 0	1869	6,728	3 6—6 2
1853	7,037	3 2—4 10	1870	6,425	3 6—6 2
1854	6,181	3 6—5 4	1871	6,320	3 10—6 2
1855	7,000	3 8—4 2	1872	7,560	4 6—6 0
1856	6,748	3 4—5 0	1873	6,170	4 4—6 6
1857	6,856	3 4—4 8	1874	6,570	4 4—6 8

AVERAGE PRICES of BRITISH WHEAT, BARLEY, and OATS, per IMPERIAL QUARTER, in each of the SIXTEEN YEARS 1859–74.

Year.	Wheat.	Barley.	Oats.	Year.	Wheat.	Barley.	Oats.
	s. d.	s. d.	s. d.		s. d.	s. d.	s. d.
1859	43 9	33 6	23 2	1867	64 6	40 0	26 1
1860	53 3	36 7	24 5	1868	63 9	43 0	28 1
1861	55 4	36 1	23 9	1869	48 2	39 5	26 0
1862	55 5	35 1	22 7	1870	46 10	34 7	22 10
1863	44 9	33 11	21 2	1871	56 10	36 2	25 2
1864	40 2	29 11	20 1	1872	57 0	37 4	23 2
1865	41 10	29 9	21 10	1873	58 8	40 5	25 5
1866	49 11	37 5	24 7	1874	55 9	44 11	28 10

CERTAIN ARTICLES of FOREIGN and COLONIAL PRODUCTION IMPORTED in the YEARS 1871–74; and their QUANTITIES.

	1871.	1872.	1873.	1874.
ANIMALS, Living:				
Oxen, Bulls, and Cows, number	208,472	139,468	157,549	157,821
Calves .. .. ,,	40,139	33,525	43,338	36,041
Sheep .. .. ,, / Lambs .. .. ,,	917,076	809,822	851,035	758,902
Swine and Hogs .. .. ,,	85,622	16,101	80,976	115,389
Bones (burnt or not, or as animal charcoal) .. .. tons	100,857	111,692	69,945	82,242
Cotton, Raw .. .. .. cwts.	15,876,248	12,578,906	13,693,472	14,062,075
Flax .. .. ,,	2,587,066	2,022,507	2,194,473	2,373,993
Guano .. .. ,,	178,808	118,704	184,921	112,285
Hemp .. .. ,,	1,295,812	1,105,983	1,251,030	1,241,115
Hops .. .. ,,	218,664	135,965	123,228	146,233
Hides untanned: Dry .. ,,	599,922	815,542	615,548	554,964
,, ,, Wet .. ,,	678,432	626,064	712,040	711,161
Petroleum .. .. tuns	35,808	25,300	65,630	85,630
Oilseed Cakes .. .. .. tons	162,804	134,300	138,119	157,476
Potatoes .. .. cwts.	847,835	5,987,429	7,473,230	3,990,991
Butter .. .. ,,	1,334,783	1,138,081	1,277,729	1,620,674
Cheese .. .. ,,	1,216,400	1,057,883	1,355,267	1,488,223
Eggs .. .. per great hundred	3,337,275	4,429,990	5,500,277	5,672,049
Lard .. .. cwts.	477,147	578,676	627,044	374,582
Bacon and Hams .. .. ,,	1,093,838	2,001,855	2,973,314	2,541,681
Salt Beef .. .. ,,	279,179	193,215	218,563	231,532
Salt Pork .. .. ,,	266,967	212,382	266,084	287,238
Clover Seeds .. .. .. ,,	340,506	290,849	278,419	256,025
Flax-seed and Linseed .. qrs.	1,310,147	1,514,947	1,443,018	1,682,875
Rape .. .. ,,	665,452	246,549	275,823	289,781
Sheep and Lambs' Wool .. lbs.	319,385,049	302,500,925	313,061,244	338,800,481

ACREAGE under each Description of CROP, FALLOW, and GREAT BRITAIN and

DESCRIPTION of CROPS and LIVE STOCK.	GREAT BRITAIN.		
	1872.	1873.	1874.
CORN CROPS :—	Acres.	Acres.	Acres.
Wheat	3,598,957	3,490,380	3,630,300
Barley or Bere	2,316,332	2,335,913	2,287,987
Oats	2,705,837	2,676,227	2,596,384
Rye	66,875	51,634	47,228
Beans	524,005	586,561	559,044
Peas	361,545	318,213	310,547
TOTAL CORN CROPS	9,573,551	9,458,928	9,431,490
GREEN CROPS :—			
Potatoes	564,088	514,682	520,430
Turnips and Swedes	2,083,507	2,121,908	2,133,336
Mangold	329,190	325,702	322,614
Carrots	16,499	15,503	13,927
Cabbage, Kohl-rabi, and Rape ..	177,800	174,762	169,285
Vetches, Lucerne, and any other crop (except clover or grass)	445,299	423,929	421,678
TOTAL GREEN CROPS	3,616,383	3,576,486	3,581,270
OTHER CROPS, GRASS, &c. :—			
Flax	15,357	14,683	9,394
Hops	61,927	63,278	65,805
Bare fallow or uncropped arable land	647,898	706,498	660,206
Clover and artificial and other grasses under rotation	4,513,451	4,366,818	4,340,742
Permanent pasture, meadow, or grass not broken up in rotation (exclusive of heath or mountain land)	12,575,606	12,915,929	13,178,012
LIVE STOCK :—	No.	No.	No.
Cattle	5,624,994	5,964,549	6,125,491
Sheep	27,921,507	29,427,635	30,313,941
Pigs	2,771,749	2,500,259	2,422,832
Total number of horses used for agriculture, unbroken horses, and mares kept solely for breeding	1,258,020	1,276,444	2,226,739
Acreage of orchard, or of arable or grass-land, used also for fruit-trees	169,808	148,221	150,526
Acreage of woods, coppices, and plantations	2,187,078	2,187,078	2,187,078

GRASS, and NUMBER of CATTLE, SHEEP, and PIGS, in IRELAND, in 1872-73-74.

Ireland.			United Kingdom, including the Islands.		
1872.	1873.	1874.	1872.	1873.	1874.
Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
228,189	168,435	188,711	3,839,532	3,670,259	3,830,767
220,057	231,023	212,230	2,543,581	2,574,529	2,507,130
1,621,813	1,510,089	1,480,186	4,340,748	4,198,495	4,088,825
8,832	8,405	8,979	75,849	60,121	56,274
10,029	11,129	9,646	534,341	598,121	568,984
1,753	1,743	1,756	364,194	321,007	312,854
2,090,673	1,930,824	1,901,508	11,698,245	11,422,532	11,364,834
991,802	903,282	892,421	1,563,691	1,425,720	1,420,825
346,464	347,904	333,487	2,439,336	2,479,847	2,476,757
34,736	38,096	38,161	364,699	364,552	361,499
3,782	3,698	3,359	20,977	19,891	17,865
50,207	37,355	41,105	228,118	212,326	210,578
46,925	42,085	44,829	495,173	468,776	470,159
1,473,916	1,372,420	1,353,362	5,111,994	4,971,112	4,957,683
122,003	129,432	106,886	137,360	144,115	116,280
..	..	..	61,931	63,278	65,806
18,512	13,474	12,187	667,299	720,990	673,376
1,799,930	1,837,483	1,906,083	6,354,319	6,240,900	6,284,925
10,241,513	10,420,695	10,472,161	22,838,178	23,363,990	23,680,416
No.	No.	No.	No.	No.	No.
4,057,153	4,151,561	4,118,113	9,718,505	10,153,670	10,281,036
4,262,117	4,486,453	4,437,613	32,246,642	33,982,404	34,837,597
1,385,386	1,044,218	1,096,494	4,178,000	3,563,532	3,537,354
540,745	531,708	525,770	1,808,259	1,817,831	1,847,148
..	325,173	325,173	..	2,512,251	..

The following remarks relating to Irish and Foreign Butter and to Cheese are extracted from 'The Grocer':—

Irish Butter.—The transactions in January were small, and butter was offered for resale below the prices current in the Irish markets; the board prices in the Cork market at the end of this month were 154*s.* for firsts and seconds, whilst in the London markets the nearly nominal quotations varied according to freshness from 142*s.* to 156*s.* for firsts. The transactions in February were very limited; the range in prices was great, owing to a portion of the stock consisting of stale parcels offered for resale. There was scarcely enough doing in sales of Irish butter in March to establish market values. In the first week of April the stock of Irish butter at the public wharves amounted only to 75 firkins; transactions were very few this month, and chiefly of low quality. The month of April commenced with a stock of only 28 firkins of Irish lying at the public wharves, and very little over 1000 packages of foreign; but, with increased supplies of the latter coming forward, prices gave way rapidly; the transactions were small. In June the effects of the shortness of the grass-crop began to tell upon the market, and led to a little more disposition on the part of the trade to buy. In July the transactions—with the exception of a few small sales of Corks—were very limited. The great heat of the weather, and the high prices asked, seemed combined to cause the trade to be afraid to hold quantity. In the early part of August there was a little more doing in sales of Irish butter, but towards the close of the month, the trade, though lightly stocked, seemed afraid to follow the advanced rates asked.

The early part of the month of September was cooler and showery, greatly improving the appearance of the pasture-lands; the last two weeks fine and much warmer, but the transactions for Irish butter were so few that quotations were governed more by the prices paying in Ireland than by the amount of business doing in the London market. The trade was out of stock, but refused to buy at the rates asked: the northern markets, however, took it freely. In October the trade still thought the asking rates too high, and have operated so sparingly that quotations continued nearly nominal, shippers in the mean time found willing buyers in the northern towns. The transactions in November were very limited, so much so, that quotations were nearly nominal. In December the transactions were also very limited, and confined chiefly to the sales of third and fourth Corks.

Foreign Butter.—In January supplies were considerably above average ones; but with comparative light stocks lying in the

London markets, and an active demand for it from our northern markets, all was cleared off fast as to hand; quotations for best Normandys ranging from 144s. to 156s. There was a steady demand for American. In February the arrivals were large, a great portion of them were of second-rate and inferior qualities. Supplies of foreign butter in March were considerably above average ones. In April supplies continued to arrive in excess of those usual at this period of the year, but the demand was such as to clear all off fast as to hand. In May, best Normandys began at 130*s.* to 140*s.*; at the end of the month, 112*s.* to 120*s.*, the lowest price throughout the season: the want of rain and the fear of short crops then began to be felt. In France the want of rain was felt in June, and advancing prices was the result. In the early part of July the supplies were heavy, but became lighter towards the end; the heat of the weather rendered it difficult to bring it here in good condition, both importers and the trade were afraid to hold quantity. Supplies of foreign butter in August were large, and a considerable portion of these were second-rate and inferior. The supplies of foreign butter in September were not quite so heavy, and there was a large proportion of second-rate and inferior amongst them; these descriptions were pressed at irregular rates, but finest held steadily. In October the supplies for this period of the year continued large; a great portion, however, was of very middling quality. For November supplies were large—say, including the out-ports, over 150,000 packages—a considerable portion consisted of doubtful qualities, the sale of which was anxiously pressed at seemingly low prices. In December the supplies were unnaturally large for the season, and a great deal of foreign butter of doubtful character was received, causing a wide range in prices.

Cheese.—In January holders of fine English were very firm, and, as usual there was a wide range in prices. In February there was also a firm market for all fine qualities, many of the buyers for country towns paying higher prices for fine English than those quoted in the London market. There was a steady demand for best qualities of American. In March the market was firm, closing at the highest quotations, and really fine English was scarce. In April the market was firm: there was a difficulty in obtaining a quantity of really fine English, and good useful parcels were in better demand. In May the best English held steadily, scarcely any variation in price; the demand for American, although not what is termed active, was sufficient to clear off nearly all the old. By June the shortness of the grass led the makers of English to expect a smaller make than usual, a firm market for fine was thus caused.

In July the scarcity of food for cows caused firmness to be shown by the makers of fine English. In August new English began to be quoted; in fact, very little good old was kept, the scarcity of food for cows throughout the summer, and consequently a lessened make gave firmness to the makers of best qualities. Country buyers were keen competitors with the London dealers; the heat of the weather, at the close of this month, causing it to be safer to move American cheese in its packages than English without them, assisted sales of the former. In September the makers of English cheese, believing last summer's production to have been lessened by the scarcity of food, held finest qualtities very firmly, asking such prices as left little prospect of profit by the resale of them. In October holders of finest qualities were firm, both English and American. In November, holders of best English were very firm; the makers of finest qualities showed no disposition to press sales at present rates; supplies of American were rather below the average. In December there was scarcely any variation in prices, and holders of fine qualities were firm; at the close of the month there was a little more doing in sales of American.

Cork Butter Market.—The hope is generally entertained at the opening of each season that the high range of prices of the preceding one was exceptional, and that more moderate figures will prevail during the future; therefore, though the market opened in April at the extreme price of 150*s.* for first and second qualities, a rapid fall was soon expected, and did take place, for by the end of May the prices of firsts, seconds, and thirds stood at 118*s.*, 114*s.*, and 105*s.* respectively, which were very nearly the same as those of the corresponding date in 1873. However, the continued dry weather of last summer soon made it evident that lower prices could not be expected, and as week after week passed without a return of the rain, which it is generally quite safe to predict in Ireland, it became evident that the make of butter must suffer in quantity; the result was that prices showed a gradual but constant advance since June last until the present time, and the season seems likely to close with higher rates than have ever yet been known. The total receipts of butter to the Cork market, for 1874, amount to 350,000 firkins, of a value of about 1,600,000*l.* Compared with 1873 the receipts show a falling off of about 12,000 firkins, but the money value of 1874 exceeds that for 1873. 12,000 firkins seem a smaller deficiency than the great drought of last summer would cause; but it must be remembered that 1873 was itself a year of short production, being 35,000 firkins less than that of 1872.

An American Cheese Dairy.—“The Old Fairfield Cheese Factory,

of Herkimer County, New York, is one of the most noted in the States. It was erected in 1864, and has from the first enjoyed the reputation of turning out what is known in the trade as 'gilt-edged fancy cheese.' It was in the southern part of the town of Fairfield that cheese-dairying took its rise as a speciality something like seventy years ago. The factory is designed to take the milk of 1000 cows. The large manufacturing-room is provided with five double vats, capable of holding 600 gallons each. The press-room is provided with a number of presses, where thirty or more cheeses can be pressed at a time. Above the press-room and wood-shed is a large room with proper fixtures, where the spring and fall cheese can be kept and cured. The factory is fed with water from the celebrated Maltanner Spring, which rises near by, and forms a large stream capable of driving machinery. This stream passes within a few feet of the end of the manufacturing-room. A large ice-house is connected with the establishment. The factory was erected by a stock company at a cost of about 6000 dols. The Old Fairfield Factory has had abundant reasons for success—viz., high, rich, rolling lands, affording sweet and nutritious feed, the pastures generally having been long in grass; plenty of cool, sweet water distributed over the farms; care in the handling of milk at the farm; and, finally, high skill in manufacturing at the factory. Mr. Fairchild, the present manager and manufacturer, says the average number of cows from which milk was delivered in the past season was 900, and the largest delivery of milk in any one day was 20,135 lbs. During the best of the season 33 cheeses per day have been made, weighing 88 lbs. each, and pressed in 15½-inch hoops."

"The milk is set at a temperature of 82°, and the curd is fit to cut in about 50 minutes. It is cut lengthwise and crosswise with the perpendicular knives, and once through with the horizontal knives; then heat is gradually applied until a temperature of 100° is reached, the curds, meanwhile, being carefully stirred to keep from packing. The time for scalding the curds occupies from one to three hours, according to the temperature of the weather and the condition of the milk. If the curds are likely to lose heat while scalding, the vats are covered, as it is not desired that the heat should get below 94°. After the acid is properly developed the whey is drawn and the curds reduced to a temperature of about 84°, salted, and put to press. The rate of salting is 3 lbs. of salt for 1000 lbs. of milk. In cutting the curds the particles are left in cubes about three-eighths of an inch in size."

STATISTICS OF DAIRY PRODUCE.

(*The following Quotations, &c., are extracted from* 'The Grocer.')

PRICES CURRENT on 1st SATURDAY in JANUARY of each YEAR, from the latest actual MARKET SALES.

	1870.	1871.	1872.	1873.	1874.	Average Annual Price in the 5 years, 1870–74.	1875.
Butter:	Per cwt.	Per cwt.	Per cwt.	Per cwt.	Per cwt.	Per cwt.	Per cwt.
Carlow, finest, F.O.B.	124s. to 130s.	130s. to 144s.	120s. to 134s.	120s. to 132s.	134s. to 142s.	126s. to 136s.	150s. to 160s.
Landed	122 ,, 130	126 ,, 146	116 ,, 136	120 ,, 134	134 ,, 142	124 ,, 138	.. ,, ..
Cork, 1sts	134 ,, 137	142 ,, 150	133 ,, 137	136 ,, 142	143 ,, 150	138 ,, 143	158 ,, 160
,, 2nds	123 ,, 125	134 ,, 142	124 ,, 129	123 ,, 133	140 ,, 146	129 ,, 135	151 ,, 154
,, 3rds, new ..	107 ,, 109	122 ,, 125	106 ,, 118	100 ,, 106	122 ,, 123	111 ,, 116	131 ,, 132
,, 4ths	100 ,, 104	112 ,, 114	84 ,, 86	87 ,, 89	108 ,, ..	98 ,, 98	115 ,, ..
Limerick	116 ,, 120	128 ,, 132	112 ,, 116	110 ,, 114	.. ,, ..	117 ,, 121	.. ,, ..
Foreign:							
Friesland	104 ,, 132	112 ,, 142	106 ,, 116	112 ,, 122	130 ,, 138	113 ,, 130	136 ,, 144
Jersey, &c.	74 ,, 130	76 ,, 130	75 ,, 124	74 ,, 120	95 ,, 140	79 ,, 129	94 ,, 144
Kiel	104 ,, 136	110 ,, 156	100 ,, 140	112 ,, 146	130 ,, 148	111 ,, 145	135 ,, 164
Normandy	90 ,, 150	.. ..	90 ,, 150	90 ,, 150	100 ,, 148	93 ,, 150	110 ,, 160
American	100 ,, 112	94 ,, 116	60 ,, 115	60 ,, 105	95 ,, 126	82 ,, 115	112 ,, 138

Cheese:							
English Cheddar, fine, new	90 ,, 94	.. ..	66 ,, 84	70 ,, 90	76 ,, 92	76 ,, 90	74 ,, 94
,, good, new	74 ,, 86	74 ,, 100	.. ..	.. ..	.. ..	74 ,, 93	.. ..
Red Somerset Loaf ..	72 ,, 84	80 ,, 92	50 ,, 72	70 ,, 76	70 ,, 80	68 ,, 81	78 ,, 88
White or yellow Cheddar Loaf	76 ,, 84	80 ,, 92	60 ,, 70	68 ,, 80	76 ,, 80	72 ,, 81	80 ,, 88
Scotch Cheddar	70 ,, 80	70 ,, 80	60 ,, 70	66 ,, 76	68 ,, 80	67 ,, 77	74 ,, 82
Cheshire, new	84 ,, 90	78 ,, 90	70 ,, 84	70 ,, 84	78 ,, 85	76 ,, 87	84 ,, 88
,, good ditto ..	66 ,, 78	60 ,, 74	50 ,, 64	56 ,, 66	60 ,, 66	58 ,, 70	70 ,, 76
Wiltshire, new	72 ,, 80	64 ,, 84	64 ,, 70	66 ,, 76	68 ,, 80	67 ,, 78	70 ,, 82
,, good ditto	62 ,, 68	.. ..	50 ,, 60	56 ,, 60	60 ,, 66	57 ,, 64	66 ,, 68
North Wilts Loaf, new	76 ,, 84	80 ,, 90	50 ,, 72	60 ,, 76	66 ,, 80	66 ,, 80	78 ,, 88
Derby ,, ,, ..	72 ,, 86	68 ,, 86	56 ,, 78	60 ,, 78	70 ,, 88	65 ,, 83	76 ,, 88
Foreign:							
American, fine	72 ,, 75	74 ,, 80	60 ,, 66	66 ,, 72	70 ,, 72	68 ,, 73	72 ,, 76
,, good	64 ,, 70	60 ,, 68	40 ,, 56	50 ,, 62	54 ,, 68	54 ,, 65	50 ,, 68
Gouda	50 ,, 62	50 ,, 64	40 ,, 64	50 ,, 64	56 ,, 66	49 ,, 64	52 ,, 60
Kanter	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
Edan, new	54 ,, 65	54 ,, 70	50 ,, 70	52 ,, 68	56 ,, 68	53 ,, 68	54 ,, 64

STATEMENT of the QUANTITY and VALUE of BUTTER imported from the UNITED STATES, BELGIUM, FRANCE and HOLLAND; and of CHEESE imported from the UNITED STATES and HOLLAND, 1864–73.

Years.	UNITED STATES.			
	BUTTER.		CHEESE.	
	Quantities.	Computed Real Value.	Quantities.	Computed Real Value.
	Cwts.	£.	Cwts.	£.
1864 ..	142,672	780,024	466,988	1,213,890
1865 ..	83,216	437,703	442,913	1,296,204
1866 ..	16,059	77,754	415,726	1,386,447
1867 ..	39,035	113,290	526,740	1,470,017
1868 ..	7,117	37,279	489,117	1,439,380
1869 ..	17,203	84,603	487,870	1,612,325
1870 ..	16,915	80,928	555,385	1,861,263
1871 ..	83,775	394,359	731,326	2,014,805
1872 ..	45,765	199,679	598,198	1,701,435
1873 ..	43,406	199,639	790,238	2,353,181

Years.	BELGIUM.		FRANCE.	
	BUTTER.		BUTTER.	
	Cwts.	£.	Cwts.	£.
1864 ..	81,575	470,167	163,020	858,793
1865 ..	70,619	433,179	353,115	1,867,085
1866 ..	76,667	426,712	452,196	2,276,493
1867 ..	80,754	470,464	450,693	2,265,147
1868 ..	70,456	405,987	393,578	2,156,824
1869 ..	85,789	481,609	407,432	2,231,450
1870 ..	84,408	516,643	289,692	1,672,899
1871 ..	94,539	523,460	304,683	1,636,006
1872 ..	74,191	409,555	355,089	1,916,795
1873 ..	76,610	439,501	446,550	2,409,861

Years.	HOLLAND.			
	BUTTER.		CHEESE.	
	Cwts.	£.	Cwts.	£.
1864 ..	336,224	1,774,462	336,831	881,972
1865 ..	345,026	1,886,486	386,962	1,100,037
1866 ..	383,225	1,979,070	426,559	1,317,231
1867 ..	326,217	1,733,459	332,628	961,245
1868 ..	343,322	1,992,414	329,565	959,547
1869 ..	415,176	2,253,420	426,913	1,262,101
1870 ..	406,795	2,388,459	422,553	1,204,830
1871 ..	390,616	1,986,708	348,148	954,236
1872 ..	269,091	1,358,579	329,535	942,537
1873 ..	279,004	1,453,875	336,654	1,013,233

JOURNAL

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ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

I.—*On the Valuation of Unexhausted Manures.* By J. B. Lawes, F.R.S., F.C.S.

On April 4, 1870, I read a Paper before the London Farmers' Club, on the "Exhaustion of the Soil, in relation to Landlord's Covenants, and the Valuation of Unexhausted Improvements." The object of the first part of that Paper was to point out and illustrate the difference between those properties of the soil which are known under the term of "*condition*," and those which are included under the term *natural*, or *standard fertility*.

I defined *condition* of land to be due to the accumulation within the soil of manurial matters which may be withdrawn, or reduced, by cropping, within a comparatively short period of time. *Condition* was stated to be a quality dependent on the expenditure of the tenant; and, subject to the terms of his holding, may be considered to be his property.

The *natural* or *standard fertility* of a soil, on the other hand, was the property of the landlord; upon it depended, in a great measure, the amount of rent he was able to obtain for his land; and although this natural fertility was not absolutely inexhaustible, it was very little liable to injury from any system of agriculture which, so far as present appearances enable us to judge, had any prospect of prevailing in this country.

The second part of the Paper related to the question of the valuation of unexhausted manures; and, taking into consideration the great difficulty in laying down rules which would be generally applicable for the estimation of the productive capability, and consequently of the money-value, of the residue of the manures which have already yielded a crop, I suggested whether it would not be possible to confine the valuation to what was above ground, and had a recognised money-value, and, in so doing, to do full justice to the outgoing tenant.

About the time that that Paper was read, Parliament was discussing Mr. Gladstone's Irish Land Act, which afterwards became the law of the land. Under that Act an outgoing tenant is entitled to claim compensation for "tillages, manures, or other like farming works, the benefit of which is unexhausted at the time of the tenant quitting his holding." The Act is very explicit in all that relates to the legal machinery by which claims may be tried or established; but it gives no information as to what constitutes unexhausted value, or how that value is to be estimated.

It could hardly be doubted that on a subject so complicated, and in regard to which the best authorities might differ in opinion very widely, much litigation would take place. Extravagant claims have been put forward; and, if current report may be trusted, there is considerable dissatisfaction with the working of the Act among the Irish tenantry.

In 1873, an English gentleman, who had been the assignee of a lease granted to a previous tenant by the late Duke of Leinster, made, at the expiration of his term, very large claims upon the landlord for unexhausted tillages and manures. The case was tried before the Chairman of Quarter Sessions; and the judgment being adverse to the tenant, he appealed, and the cause was then heard by the Lord Chief Justice of Ireland. On that occasion I was present as a witness for the defendant; and I had ample opportunity of observing how great were the difficulties with which both the Judge and the opposing counsel had to contend. On my return to England, I wrote a pamphlet on 'Unexhausted Tillages and Manures, with reference to the Landlord and Tenant (Ireland) Act.' Part of the Paper had reference to the trial, and had, therefore, only a local and temporary interest. The remainder was devoted to an attempt to place a value on the unexhausted residue, under various circumstances, of the most important of the manures which are likely to become the subjects of claim for compensation.

In reference to this subject, the Committee on "Unexhausted Improvements" appointed by the Council of the Central and Associated Chambers of Agriculture, have done good service in collecting particulars of the allowances to the outgoing tenant for purchased cattle-food and manures, and other improvements, according to the established custom in different counties and districts.

Further, it is now a much-debated question, whether there should not be legislation in regard to England and Scotland, as already there is for Ireland, to secure to the outgoing tenant compensation for his unexhausted improvements; and, among others, especially for the unexhausted residue of purchased feeding-stuffs and manures.

It seems desirable, therefore, at the present time, to pass in review the state of existing knowledge on the subject of the value of such unexhausted improvements, and to compare the results arrived at by different methods, or on different bases of valuation. Accordingly, I propose to consider the basis, and the results, of the estimates of the value of the unexhausted residue of purchased (or saleable) feeding-stuffs and manures—

First: As set forth in my Paper on 'Unexhausted Tillages and Manures with reference to the Landlord and Tenant (Ireland) Act.'

Secondly: According to the established custom of various counties and districts, as recorded by the Committee on Unexhausted Improvements appointed by the Council of the Central and Associated Chambers of Agriculture.

Thirdly: Confining the valuation to what is above ground, and has a recognised and easily-ascertainable money-value.

SECTION I.—*Valuation of the Unexhausted Residue of purchased Feeding-stuffs and Manures, founded on the original Manure-value of the Article, and on the results of direct experiments, and of common experience, with different Manures.*

In the first place, I propose to direct attention to some of the data furnished by my experiments at Rothamsted, in regard to the amount, and to the condition, of the unexhausted residue left in the soil by different descriptions of manure; and to attempt to construct a scale of valuation for different manures, founded partly on those data, and partly on the recognised experience of practical agriculture.

MANURES.

Before considering the question of unexhausted manures, it will be well to say a few words on the action and value of manures generally, and especially on the difference in the action and value of different descriptions of manure.

The term *manure* includes a great variety of substances, which, when applied to the soil, increase the growth of crops. Formerly, the only manure employed was that produced by animals consuming food, and using litter, which were exclusively the produce of the farm itself. Modern agriculture has greatly altered this state of things. We have now a long list of manures, derived from sources external to the farm itself, which are in common use by farmers.

The following is an enumeration of the most important of the manures, the unexhausted residues from which are likely to become the subjects of claim for compensation:—

1. Manure produced from purchased (or saleable) feeding-stuffs.
2. Farmyard, or town-stable, manure.
3. Rapecake (or other cake) used as manure.
4. Bones.
5. Nitrate of soda.
6. Sulphate of ammonia.
7. Superphosphate of lime, made from mineral phosphates.
8. Guano, in its natural state, or manufactured.
9. Other manures of more or less unknown composition.*
10. Liming, chalking, marling, &c.

The difference in the price at which the different items of purchased manure in this list can be brought upon the farm is very wide indeed.

By way of illustration, it may be assumed that town-made dung will, in the majority of cases in which it is largely used, cost the farmer about 7*s.* 6*d.* per ton delivered on his farm. Nitrate of soda will, however, cost him, say 15*s.* per cwt., sometimes more and sometimes less. Thus, he finds it worth his while to give about as much for 1 cwt. of nitrate of soda, as for 2 tons of stable-dung; or, in other words, about 40 times as much for an equal weight of the one manure as of the other.

Sulphate of ammonia is dearer than nitrate of soda; and although it is not purchased to any great extent by the farmer, it is much used in the manufacture of mixed artificial manures.

Again, Peruvian guano contains, when of good quality, a considerable quantity of ammonia, as well as phosphates, and it costs about 13*l.* per ton; whilst inferior guano, poor in ammonia but rich in phosphate of lime, and superphosphate of lime containing no ammonia at all, sell for only from one-third to one-half as much.

Nitrate of soda contains nitrogen as nitric acid; sulphate of ammonia contains it as ammonia; and Peruvian guano also contains, or by decomposition yields, it as ammonia. In fact, the money-value as manure, of nitrate of soda, or of sulphate of ammonia, is exclusively, and that of Peruvian guano chiefly, due to the nitrogen they contain.

Thus it will be seen that the highest-priced manures are those which are rich in nitrogen. A few illustrations may here be given of the effects of nitrogenous manures upon the growth of crops.

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* Of such manures, the Schedules of the Committee on Unexhausted Improvements include particulars relating to Kainit, ashes, night-soil, and town manure, soot, sea-weed, fish, and "other fertilisers unenumerated."

Barley has now been grown in one field at Rothamsted for 23 years in succession. On one portion there has been applied, every year, a mineral manure, consisting of salts of potass, soda, and magnesia, and superphosphate of lime; and the average produce over the 23 years has been $26\frac{1}{4}$ bushels of dressed corn per statute acre. On other portions there were used, every year, the same mineral manures, with the addition of ammonia-salts or nitrate of soda, and the average produce then reached very nearly 49 bushels per acre per annum; or nearly double that by the mineral manures used alone. Indeed, the produce obtained by using this mixture of mineral and nitrogenous manure was even rather higher than that yielded by the use, for 23 years in succession on the same land, of 14 tons of farmyard-manure per acre per annum.

In an immediately adjoining field wheat has been grown, without manure, and by different descriptions of manure, for 31 years in succession, and with very similar results. Mineral manures alone have given very little increase of produce; nitrogenous manures alone, in the form of ammonia-salts or nitrate of soda, have given considerably more produce than mineral manure alone; and the mixture of mineral and nitrogenous manures has yielded much more still, and more, of both corn and straw, than the annual application of farmyard-manure.

Thus, then, not only are those manures which are rich in nitrogen the highest priced, but direct experiments, extending over a long series of years, have shown that nitrogen has in reality a higher money-value for the purposes of manure than any of the other substances used.

It will be seen further on, how much the settlement of all questions of compensation for unexhausted manures must depend upon the estimate formed of the amount, and of the condition, of the nitrogen of the manure remaining in the soil; and how much this, in its turn, must depend on the description of the manure employed, the character of the soil to which it has been applied, the characters of the climate or of particular seasons, and the kinds of crop which have been grown since the application.

Unexhausted Manures.

When a manure is applied to the soil, what happens? This point may be illustrated very usefully for our present purpose by reference to direct results obtained at Rothamsted.

To certain plots given quantities of salts of potass, soda, and magnesia, superphosphate of lime, and salts of ammonia (or nitrate of soda), have been applied every year; and for between

twenty and thirty years full crops of wheat and of barley have been obtained under this treatment.

Analysis of the produce has shown that a large proportion of the nitrogen supplied in the manure has remained unrecovered in the increase of the crop produced by its use. Still, any reduction in the quantity annually applied was followed by a diminution in the amount of the crop; or, if the application were entirely stopped, there was frequently little or no effect upon succeeding crops from any unexhausted residue.

Analysis of the soil showed that a portion of the nitrogen of the manure which was not recovered in the increase of crop was accumulated within the soil. But there yet remained a large amount of the supplied nitrogen to be otherwise accounted for than either in the crop or in the soil.

It was next determined that the drainage-water from the various plots of the experimental wheat-field, which was already pipe-drained, should be examined. Numerous samples of the drainage-water from the differently-manured plots, collected at different periods of the year, have, by their own desire, been supplied for analysis, independently, to Professor Voelcker and to Professor Frankland. Their analyses proved that the drainage-waters frequently contained a large amount of nitrogen in the form of nitrates; that the quantity of nitrates was the greater the greater the amount of ammonia-salts applied as manure; and that (after autumn-sowing) the quantity was very much greater in the winter, than subsequently in the spring and summer.

In one case, after a heavy dressing of ammonia-salts, Dr. Frankland found a quantity of nitrates in the drainage-water, which would correspond to a loss of nearly 18 lbs. of nitrogen per statute acre, provided an inch of rain had passed as drainage of that strength. On another occasion, after a heavy dressing of nitrate of soda, Dr. Voelcker found a quantity of nitrates in the drainage-water, which, reckoned in the same way, would be equivalent to a loss of about 13 lbs. of nitrogen per acre.

Lastly, on this point, calculation led to the conclusion, that most probably the whole of the nitrogen which had been supplied as manure in the ammonia-salts or nitrate of soda, and which was not either recovered in the increase of crop, or retained by the soil in a very slowly available condition, was drained away and lost.

When the manure employed contains or yields ammonia, what happens is, that the ammonia becomes more or less rapidly oxidated in the soil, and so converted into nitric acid, which is washed away in the drainage-water, chiefly in combination with lime, or soda, or both, if not in the mean time taken up by a

growing plant. When, however, nitrate of soda is applied, its great solubility, and the much less power of the soil for the absorption of it, or of its products of decomposition, than for that of ammonia, render it more liable still to loss by drainage if heavy rain should follow soon after sowing.

Although the *nitrogen* of manures is thus found to be very liable to loss by drainage, direct experiments show that the two important mineral constituents—*phosphoric acid* and *potass*—are much less liable to such loss.

Thus, Dr. Voelcker's analyses of the drainage-waters showed them to contain very little of either phosphoric acid or potass; and analyses of the soils themselves, made by Hermann von Liebig, son of the late Baron Liebig, showed that they contained considerably more of both phosphoric acid and potass—especially in the upper layers—the greater had been the supplies of them by manure. Experiments in the field further showed that these substances, though remaining dormant and ineffective in the soil in the absence of a sufficient supply of nitrogen, become effective even for twenty years or more, after their application, if nitrogen in an available form be also provided within the soil.

Of the three constituents of manures—*nitrogen*, *phosphoric acid*, and *potass*—which, in the sense that by the production and sale of corn and meat they are the most likely to become relatively deficient, are the most important constituents of manures generally, it is then proved, that the *nitrogen* is, at any rate when applied to ammonia-salts or nitrate of soda, very liable to loss by drainage, whilst the phosphoric acid and potass are, in a much greater degree, retained by the soil.

When farmyard-manure is employed, or other manures containing a large quantity of nitrogenous organic matter are used, the result is not quite so simple. For example, in farmyard-manure a portion of the nitrogen exists as ready-formed ammonia, but a large proportion becomes only very gradually converted into ammonia as the nitrogenous organic matter decomposes in the soil. Indeed, owing to the slow decomposition of dung, and the tardiness with which a large proportion of its nitrogen becomes available for the use of the growing crop, three or four times more nitrogen in the form of dung, than in active artificial manures, must be applied to produce the same effect upon the immediately succeeding crop.

How slow is the perfect decomposition of dung in the soil, and how slowly a large proportion of its nitrogen becomes available for the use of growing crops, is strikingly illustrated in the following facts:

In the experiments at Rothamsted on permanent grass-land, one

plot received 14 tons of farmyard-manure per acre per annum, for 8 years, 1856-'63, and gave an average produce of 43 cwts. of hay, against $23\frac{3}{4}$ cwts. on the unmanured plot over the same period. During the subsequent 11 years, 1864-'74, there has been no further application of dung or of any other manure on the previously dunged plot, and the average produce over the 11 years has been $33\frac{1}{2}$ cwts. of hay, against $19\frac{1}{2}$ over the same period on the plot unmanured from the commencement. The total *increase* during the 8 years of the application of the dung was 7 tons $12\frac{1}{2}$ cwts. of hay; and the total *increase* during the next 11 years, due to the residue of the dung previously applied, was 7 tons $13\frac{1}{2}$ cwts.; but it has fallen off very much during the later years, averaging considerably less than one-half as much over the last 5, as over the first 6 of the 11 years. It is probable, that during the whole 19 years, not more than two-thirds as much nitrogen has been removed in the total produce of hay as was supplied in the manure, and the increase of nitrogen over that contained in the permanently unmanured produce has probably been not one-fourth as much as was supplied.

Again, for twenty years in succession 14 tons of dung were applied per acre on one plot in the experimental barley-field. Calculation showed that a much smaller proportion of the nitrogen of the dung was taken up by the increase of crop, than of that supplied in ammonia-salts or nitrate of soda; and, judging from other experiments, it is concluded that the percentage of nitrogen in the surface-soil has been increased by the residue of the dung to nearly double that of any other plot in the field. Yet when, after twenty years, the application of dung was stopped on one-half of the plot, and continued on the other half, the average produce over the next three years was, without further application, 44 bushels of dressed corn, and 2684 lbs. of straw; but where the application was continued, it was, over the same three years, $52\frac{1}{2}$ bushels of dressed corn, and 3502 lbs. of straw; or there was an average per acre per annum of $8\frac{1}{2}$ bushels more of dressed corn, and 818 lbs. more straw, where the dung was applied afresh, than where the application had been discontinued. It is true that the produce without further application was large, and no doubt largely due to the residue from the previous applications of dung; but, notwithstanding the very great accumulation within the soil of nitrogen, and, doubtless, of all other constituents also, the produce did not reach the maximum which the characters of the seasons admitted of, but was considerably exceeded on the fresh application of dung.

Dung, however, possesses two very important properties—one mechanical and the other chemical. By reason of its bulk, and

the quantity of organic matter it contains, it serves to render the soil more open and porous, and so to enable it not only to retain more water in a favourable condition, but also to absorb and retain more of the valuable constituents of the manure, and so to arrest the passage of them in solution into the drains. Further, by the gradual decomposition of the organic matter of the dung, the pores of the soil become filled with carbonic acid, which probably serves to retard the oxidation of the ammonia into the more soluble form of nitric acid, in which it would be more liable to be washed out and lost by drainage. From these facts it will be readily understood how it is that dung is more lasting in its effects than the more active artificial manures.

Still, in the experiments at Rothamsted in which dung has been applied year after year for many years in succession, there is a large amount of the nitrogen so supplied which is not yet accounted for either in the increase of crop or in the soil. Whether there is an ultimate loss of a greater or a less proportion of that supplied than when ammonia-salts or nitrate of soda is used; whether the loss will be proportionally the same when dung is used in more moderate quantity; or whether the loss be wholly, or chiefly, by drainage, or in other ways, the evidence at present at command is not sufficient to determine with certainty.

From the foregoing observations on the characteristics of some of the most important descriptions of manure, it will be obvious how essential it is to take into careful consideration the peculiar properties, and probable duration of effect, of different manures, if we would hope to arrive at anything like a fair estimate of the money-value of the unexhausted residue they leave in the soil under various circumstances.

Guided by such knowledge as I possess on the various essential points of the question, I will now endeavour to estimate the value of the unexhausted residue of various manures, under the circumstances in which that value is most likely to become the subject of claim for compensation. In all cases, the valuation is expressed in the number of shillings estimated to be due to the outgoing tenant, for twenty shillings original *manure-value*. The valuations given must, however, be taken as only approximately correct, as the amounts due might be affected very materially—according to the cleanliness or foulness of the land, the lightness or heaviness of the soil, the dryness or wetness of the locality or of particular seasons, and the difference between the purchasing price of the food or manure and its actual and relative value.

1. Manure from Purchased (or Saleable) Feeding-stuffs.

Claims for compensation for unexhausted manures will probably arise more frequently under this head than under any other. It will be necessary, therefore, to consider the question in some detail.

When the farmer uses purchased feeding-stuffs, or food the produce of the farm which he would otherwise be justified in selling, he looks for his remuneration partly to the increased value of his animals, and partly to the value of the manure obtained from them. The increased value of the animals is of itself seldom, if ever, equal to the cost of the food consumed. Unless, therefore, the outgoing tenant can rely upon obtaining compensation for the value of the manure produced from such food, he must either cease to purchase it, and feed his animals on the non-saleable produce of the farm alone for a year or two before he leaves it, or he must submit to a loss which sometimes will be very considerable.

Before we can approach the question of the value of the *unexhausted residue* of manure produced by the consumption of purchased (or saleable) food-stuffs, it is necessary to come to some decision as to the original value of such manure. In other words, we must endeavour to determine how much of the cost of any particular food should be charged to the manure account.

With regard to the value of different foods for feeding purposes, it may be stated in general terms, as the conclusion drawn from hundreds of feeding experiments with different descriptions of food made at Rothamsted, that, weight for weight, there is very much less difference in the *feeding-value* than in the *manure-value* of foods which are included in what may be called the same class. For instance, it will make comparatively little difference, so far as the increase in live-weight of the animal is concerned, whether a ton of cake, a ton of pulse, a ton of Indian meal, or a ton of barley, be given to fattening oxen or sheep, and comparatively little whether a ton of clover-hay or a ton of meadow-hay be used. Within each of these classes of food, however, there would be a much wider difference in the value of the manure which the consumption of a ton of each of them would produce.

Having regard to the results of the feeding-experiments above referred to, and taking into consideration the known average composition of different descriptions of food, an estimate was made of what proportion of certain of the constituents in a ton of various foods would, on the average, be stored up in the animal itself, and what proportion would be obtained in the manure produced. The value, for manure, of those constituents was

then calculated, and the results are given in Table I., below, the substance of which I first published about fifteen years ago. Those estimates of *manure-value* were, at the time, considered by some to be somewhat too high. They have lately been carefully reconsidered; and taking into account the higher money-value of some of the constituents at the present time, it has been decided to make but little further alteration than to add a few articles to the list that were not originally included in it.

TABLE I.—ESTIMATED VALUE of the MANURE obtained by the CONSUMPTION of different ARTICLES of FOOD, each supposed to be good quality of its kind.

No.	DESCRIPTION OF FOOD.	Money-value of the Manure from one Ton of each Food. £	s.	d.
1	Cotton seed-cake, decorticated	6	10	0
2	Rape-cake	4	18	6
3	Linseed-cake	4	12	6
4	Cotton seed-cake, not decorticated	3	18	6
5	Lentils	3	17	0
6	Beans	3	14	0
7	Tares	3	13	6
8	Linseed	3	13	0
9	Peas	3	2	6
10	Indian meal	1	11	0
11	Locust-beans	1	2	6
12	Malt-dust	4	5	6
13	Bran	2	18	0
14	Coarse pollard	2	18	0
15	Fine pollard	2	17	0
16	Oats	1	15	0
17	Wheat	1	13	0
18	Malt	1	11	6
19	Barley	1	10	0
20	Clover-hay	2	5	6
21	Meadow-hay	1	10	6
22	Bean-straw	1	0	6
23	Pea-straw	0	18	9
24	Oat-straw	0	13	6
25	Wheat-straw	0	12	6
26	Barley-straw	0	10	9
27	Potatoes	0	7	0
28	Parsnips	0	5	6
29	Mangold wurtzel	0	5	3
30	Swedish turnips	0	4	3
31	Common turnips	0	4	0
32	Carrots	0	4	0

The prices given in the foregoing Table represent what it will be convenient to term the *manure-value* of a ton of the different

descriptions of food; that is to say, the value of the manure provided it reached the soil without material loss, and was not subject to loss by drainage before the growth of a crop. These prices might conveniently be taken as a basis in the settlement of claims for compensation for the unexhausted residue of manure derived from the consumption of purchased or saleable feeding-stuffs, provided the system of valuation now under consideration were adopted.

Anyone acquainted with the cost and the feeding-value of the different foods will see, by a glance at the Table, how little connection there is between either the cost, or the feeding-value, of a ton of the different foods, and what may be termed their *manure-value.*

It is clear, therefore, that it would be quite fallacious to base a claim for compensation for the unexhausted manure from purchased food, either upon the number of tons of food consumed, regardless of the description of that food, or upon the amount of money expended in its purchase. For example, the cost of a ton of undecorticated cotton-cake, and of a ton of locust-beans, would be much about the same; but the Table shows that the estimated value of the manure from the consumption of a ton of the cotton-cake would be 3*l.* 18*s.* 6*d.*, whilst that from a ton of locust-beans would be only 1*l.* 2*s.* 6*d.* Hence, the same outlay—according as a ton of the one or of the other of these two descriptions of food were purchased—would result in a difference of 2*l.* 16*s.* in the value of the manure thereby brought upon the farm.

The *manure-value* alone should, therefore, be adopted as the basis of any calculations of the value of the unexhausted residue of manures derived from the consumption of purchased or saleable food-stuffs.

Adopting the *manure-value* of the different foods, as given in the Table, I will now endeavour to estimate, to the best of my ability, the value of the unexhausted residue of such manure, under various circumstances which are likely to occur.

When the ordinary manure of the farm is enriched by the consumption of purchased or saleable foods, the first crop grown after the application of such manure will be considerably increased. The second and third crops will, according to circumstances, be more or less benefited; but, practically speaking, there will be no unexhausted residue left at the end of the rotation.

If purchased food be consumed with a root-crop by the outgoing tenant, and he take no crop grown by the manure so produced, he should be allowed compensation at the rate of 17*s.* for every 20*s.* of the original *manure-value* of the food if it have been consumed on the land, or 16*s.* if consumed in the yards. If he

take one corn-crop produced by such manure, sell the corn, but leave the straw on the farm, he should be allowed 7*s.* for every 20*s.* of the original *manure-value* of the purchased or saleable food. If he have taken a second corn-crop, leaving the straw, he should be allowed 1*s.*; or if, instead of a second corn-crop, grass or hay be grown and consumed on the farm, 2*s.*; but if the second crop after the roots be hay which he has sold, nothing should be awarded to him.

If purchased or saleable food be consumed on grass-land, and the outgoing tenant have not afterwards removed a crop of hay, he should be allowed 18*s.* for 20*s.* original *manure-value* of the food. If he have taken one crop of hay, and consumed it on the farm, he should be awarded 11*s.*; but if the hay have been sold, only 2*s.* for 20*s.* of the *manure-value* of the food. After a second year's hay-crop, if consumed, 2*s.*; but if sold, nothing should be allowed. If the land be only pastured, and purchased food be consumed on it for one, two, or three years before leaving, the compensation might fairly be fixed at 18*s.* for 20*s.* original *manure-value* after one year, at 12*s.* after two years, and at 4*s.* after three years.

2. Farmyard or Town-stable Manure.

Farmyard-manure, made from the produce of the farm, should not be made the subject of any claim for compensation by the outgoing tenant, whether such manure have grown a crop, or remain in the yards, or on the land, unless he paid for it under the same conditions on entry. The cases of the enrichment of such manure by the use of purchased (or saleable) cattle-food would be taken into account under the provisions of the previous sub-section (1).

When stable-manure is purchased and used in large quantities, and the application has extended over a long series of years, as, for instance, in the case of garden-ground, the unexhausted residue remaining in the soil is very great, and large crops may be taken from such land, without further manuring, for a number of years in succession. Such cases would require special consideration and adjudication, if not provided for by special agreement, as would generally be the case.

When purchased stable-manure is only used in the moderate quantity usual in ordinary agriculture, and only once in the course of a rotation of four or five years, it may be assumed that towards the end of such period no unexhausted residue would remain which would be sufficient to justify a claim for compensation to the outgoing tenant.

If purchased stable-manure be applied for roots which are con-

sumed on the land, 17*s.* for every 20*s.* of the original value of the manure may be allowed; but if the roots be consumed in the yards, only 16*s.* If one corn-crop be afterwards taken, the corn sold, but the straw left on the farm, 9*s.* may be allowed; if a second crop have been taken, the corn sold, but the straw left, 3*s.* should be allowed; or if, instead of a second corn-crop, grass or hay be grown and consumed one year, 5*s.*; but if the hay be sold, or the grass have been grazed a second year, only 2*s.* should be allowed.

If such manure be applied directly for a corn-crop, the corn sold, and the straw left, 12*s.* for 20*s.* of the original value of the manure may be awarded. After a second corn-crop, 6*s.*; or if, instead of a second corn-crop, grass or hay be grown and consumed one year, 8*s.*; or if the first year's hay be sold, or the produce grazed or consumed a second year, only 4*s.* should be allowed.

If the manure be applied directly to grass-land, and the produce is entirely grazed, 18*s.* may be allowed after one year, 14*s.* after two years, 8*s.* after three years, and 2*s.* after four years. If the manure be applied to grass-land, and hay be taken exclusively for consumption on the farm, the allowance should be 16*s.* after one year, 12*s.* after two years, and 6*s.* after three years; or if the hay be sold, 10*s.* after one year, 4*s.* after two years, but nothing after three years should be allowed.

3. Rape-cake (or other Cake) used as Manure.

When rape-cake, or other cake, is used as manure, a considerable portion of it decomposes pretty rapidly in the soil, and the more so the lighter and more porous the soil. It yields up a much larger proportion of its nitrogen, and other manurial constituents, in the first year of its application, than does farmyard-manure; and accordingly, in practice, a quantity not containing one-fourth the amount of nitrogen of an ordinary dressing of dung would be applied to produce the same effect on the first crop. An ordinary dressing of rape-cake, therefore, after the first crop, leaves a very much less unexhausted residue than an ordinary dressing of dung. A given quantity of nitrogen applied as rape-cake would, on the other hand, be less rapidly available and effective than the same quantity applied as nitrate of soda, sulphate of ammonia, or Peruvian guano; but it would be less liable to loss by drainage, and would, therefore, leave a larger proportion as unexhausted residue after the first crop, than either of the above-named more rapidly active manures.

If the outgoing tenant have applied cake as manure for a root-crop, and the roots have been consumed on the farm, he should

receive compensation at the rate of 16*s.* for 20*s.* cost of the manure if they were consumed on the land, and of 15*s.* if consumed in the yards. If a corn-crop have been grown after the roots, the corn sold, and the straw left, he might receive 7*s.* for 20*s.* cost of the manure; if a second corn-crop, 1*s.*; or if, instead of a second corn-crop, grass or hay be grown and consumed, 3*s.*; but if hay be sold, nothing should be allowed.

If the cake be applied directly for a corn-crop, the corn sold, and the straw left, 7*s.* for 20*s.* cost of the manure may be allowed. If a second corn-crop have been taken, 1*s.*; but if a third, nothing should be allowed. If, instead of a second corn-crop, grass or hay be grown and consumed, after one year, 3*s.*, or after two years, 1*s.*; but if hay be sold, nothing should be awarded.

4. Bones.

Ordinary crushed or half-inch bones decompose less rapidly, and are, therefore, less rapidly active than finely-ground bones. In either state bones are less rapidly active than rape-cake, and, like rape-cake, are much less so than nitrate of soda, ammonia-salts, or guano. The action of bones depends, moreover, very much upon the characters of the soil to which they are applied. In heavy soils their action is very slow, and therefore the more lasting; but in light soils it is more rapid, and less lasting.

In the case of soils to which experience has shown that bones can be applied with effect and profit for the root-crop, if so applied, and no crop have been grown from the manure produced by the consumption of the roots, the allowance might be 17*s.* for 20*s.* original value, if the roots have been consumed on the land, or 16*s.* if consumed in the yards. If a corn-crop have been taken after the roots, the corn sold, and the straw left, 8*s.*; if a second corn-crop, 2*s.*; if, instead of a second corn-crop, grass or hay be grown and consumed one year, 4*s.*; or if hay be sold, or grass or hay consumed a second year, only 1*s.* should be allowed.

If bones be applied to suitable grass-land, which is entirely grazed, 18*s.* for 20*s.* original value may be allowed after the first year, 13*s.* after the second, 6*s.* after the third, and 1*s.* after the fourth year. If the grass be made into hay and consumed on the farm, 16*s.* after one year, 10*s.* after two years, and 3*s.* after three years, may be allowed. If the hay be sold, 10*s.* may be allowed after the first year, 4*s.* after the second, but nothing after the third year.

5. Nitrate of Soda.

From what has been already said of the loss of the nitrogen of manure by drainage, and especially of the very great loss that may arise when such soluble and rapidly active nitrogenous manures as nitrate of soda or ammonia-salts are used, it will be readily understood that, when they are employed, we have not to look forward very far to reach the limit of their action, and consequently the period at which any claim for compensation for their unexhausted residue should cease. This point is in fact sooner reached in their case than in that of any other nitrogenous manures. Next in order in lasting character, so far as the nitrogen is concerned, comes guano, then perhaps, folding, then rape-cake, and then bones; whilst farmyard-manure is the most lasting of all.

Notwithstanding the very great solubility of nitrate of soda, and its greater liability to loss by drainage than any other nitrogenous manure, some experiments at Rothamsted have shown that after it had been used in large quantities, and for many years in succession, considerable benefit accrued to future crops. To what extent this result was due to the disintegration of the subsoil, by which it became more porous, more capable of retaining water in a condition favourable for the growing crop, and more permeable to its roots, and how much to the retention of nitric acid by virtue of the increased porosity, and therefore increased surface for absorption, of the subsoil, there is not sufficient evidence to show. It would, indeed, be quite unsafe to assume that any conclusions applicable to ordinary practice can be drawn from these results, obtained under such exceptional circumstances.

It must in fact, for practical purposes, be assumed that nitrate of soda, used only occasionally, and only in the moderate quantities usually applied, leaves no beneficial residue after the removal of the first crop. Whatever is not taken up by the crop itself, or washed out during its growth, will probably be in great part drained away in the winter following, leaving at any rate but a small, an uncertain, and a doubtfully effective residue.

If nitrate of soda have been used for roots consumed upon the farm, and the manure so produced have not yielded a crop, 15*s.* for 20*s.* original value of the manure may be allowed if the roots have been consumed on the land, or 14*s.* if in the yards. If the manure produced from the consumption of the roots have yielded a corn-crop, the corn sold and the straw left, 4*s.* for 20*s.*; or if a second corn-crop have been taken, 1*s.*; or if instead of a second corn-crop, grass or hay be grown and consumed, 2*s.* may be allowed.

When nitrate of soda is applied for a corn-crop, the grain sold by the outgoing tenant, and the straw left on the farm, he should receive 6*s*. for 20*s*. cost of the manure; nothing after a second corn-crop; but if, instead of a second corn-crop, grass or hay be grown and consumed, 1*s*.

If nitrate of soda have been applied to grass which has been only pastured, 16*s*. for 20*s*. of original value of the manure should be allowed after one year, 10*s*. after two years, and 2*s*. after three years; if hay have been taken and consumed, 14*s*. after the first year, 8*s*. after the second year, and 1*s*. after the third year; but if the hay have been sold, 2*s*. after one year, but nothing afterwards should be allowed.

6. Sulphate of Ammonia.

The only salt of ammonia used to any extent for agricultural purposes is the sulphate of ammonia. As already said, this is used to a considerable extent, but chiefly in the manufacture of mixed manures. When sown in the autumn it will be more liable to loss by drainage than when sown in the spring; but when sown in the spring, it will probably be less liable to loss by drainage than nitrate of soda sown at the same time. It is more liable to such loss in the case of light and porous soils and subsoils, than of soils and subsoils of more retentive character.

The same rules for compensation will be applicable to sulphate of ammonia as to nitrate of soda, provided the circumstances of its application, as above referred to, be the same.

7. Superphosphate of Lime made from Mineral Phosphates.

It has been explained that the phosphoric acid and the potass of manures are comparatively little liable to loss by drainage, at any rate when applied to the heavier soils. In fact, superphosphate leaves a considerable unexhausted residue; but that residue is, as a rule, without appreciable effect on succeeding crops, unless nitrogenous manure be applied to take it out. If, therefore, the crop for which the manure has been applied has been wholly sold by the outgoing tenant, no residue will remain to which a money-value can be assigned.

The most prominent effect of superphosphate of lime when applied to a root-crop is to cause a great development of root-fibres, thus enabling the plant to gather up much more of other food from the soil. It therefore serves to increase the immediate effect of other manures supplied with it; also to turn to

account accumulations within the soil which, if not taken up, would be liable to loss by drainage.

When superphosphate has been applied to roots, and no crop has been taken from the manure produced by their consumption, 9*s*. for 20*s*. of its cost may be allowed if the roots be consumed on the land, or 8*s*. if in the yards; or if corn have followed the roots, the grain sold and the straw left, 2*s*. may be allowed.

When superphosphate has been applied for a corn-crop, the corn sold and the straw left, compensation to the extent of 5*s*. for 20*s*. cost of the manure might be granted.

If superphosphate have been applied to grass-land which has been grazed, for every 20*s*. cost, 12*s*. after one year, 4*s*. after two, but nothing after three years should be allowed. If applied to grass-land, and hay have been taken and consumed, 10*s*. after one year, 2*s*. after two years, and nothing after three years. If hay have been sold, nothing should be claimed.

No compensation should be claimed for the unexhausted residue of superphosphate, whenever a second crop of any kind has been taken since the application, excepting corn after roots, grass grazed, or hay consumed, as above specified.

8. Guano, in its Natural State, or Manufactured.

Under the existing conditions of the Peruvian guano trade it is impossible to speak with any certainty, even as to the value of guano as a direct manure. It must therefore be more difficult still to speak definitely as to the value of the residue it may leave in the soil after the removal of a crop.

At one time the farmer could calculate upon receiving guano containing nitrogen equal to 16 per cent. of ammonia; more recently he had to be satisfied with 14 per cent.; and more recently still, not only a lower average per cent. than this, but great uncertainty whether he would receive that amount, half as much, or even less.

The present agents for the sale of Peruvian guano in this country have, however, quite recently informed me, that, during the time the agency has been in their hands, their importations have averaged nearer 13 than 12 per cent. of ammonia, and that cargoes analysing anything below 12 per cent. have been quite the exception. Such guano, in its natural state, will probably also contain from 25 to 30 per cent. of phosphates. But some they mix with sulphuric acid, and manufacture it into a substance of uniform quality containing nitrogen equal to about 10 per cent. of ammonia, superphosphate equal to about 20 per cent. of phosphate rendered soluble, and only about 4 per cent. of phosphates left undissolved.

Such a manufactured guano would rank in a position intermediate between the more highly or purely nitrogenous manures (such as nitrate of soda and sulphate of ammonia) on the one hand, and a superphosphate of lime on the other; or rather, it would be equivalent to a mixture of the two.

Other manure-dealers also prepare "dissolved guano," but of very varying composition.

From what has been said in regard to the action, and the value, of different descriptions of manure, it will be readily understood that the value of guano will depend very greatly upon the percentage of nitrogen it contains. The nitrogen in guano, whether "dissolved" or not, should be valued at the rate for the time of that in nitrate of soda, or sulphate of ammonia.

If the guano be "dissolved" by admixture with sulphuric acid, the value of the phosphates rendered soluble may be reckoned as the same as that in superphosphate of lime, but if not dissolved at only two-thirds as much.

Thus it will be obvious that the mere price paid for guano cannot be accepted as the basis upon which to calculate the value of its unexhausted residue after it has yielded a crop. It is essential for the establishment of a claim for compensation that the composition of the guano should be known, and its actual value calculated, according to the amount of ammonia it contains or yields, the amount and condition of its phosphates, the price of ammonia in sulphate of ammonia, and that of soluble phosphate in superphosphate.

If the guano have been acted upon by sulphuric acid, both its nitrogen and its phosphates will probably be more effective on the first crop, and leave, therefore, the less for succeeding crops, than if it were used in its natural state. But the difference would not be either sufficiently great, or sufficiently uniform on various soils and in various seasons, to justify a difference in the scale of valuation of the unexhausted residue.

If guano, whether dissolved or not, have been used for roots consumed upon the farm, and the manure so produced has not yielded a crop, 15*s.* for 20*s.* estimated value of the guano may be allowed if the roots be consumed on the land, or 14*s.* if in the yards. If the manure produced from the roots have yielded a corn-crop, the corn being sold and the straw left, 4*s.* for 20*s.* value of the guano should be allowed; if a second corn-crop have been taken, 1*s.*; or if, instead of a second corn-crop, grass or hay be grown and consumed, 2*s.*

If guano, whether dissolved or not, have been directly applied for a corn-crop, the grain sold, and the straw left, 6*s.* for 20*s.* value of the guano might be awarded. If after one corn-crop,

grass or hay be grown and consumed on the farm, 1*s.* may be allowed; but if a second corn-crop be taken, or hay be cut and sold, no claim for compensation should be admitted.

If guano be applied to grass-land, 16*s.* for 20*s.* estimated original value may be allowed after one year, 10*s.* after two years, and 2*s.* after three years, if the produce be only grazed; if it be made into hay which is consumed, 14*s.* after one year, 8*s.* after two years, and 1*s.* after three years; or if a crop of hay be taken and sold, only 2*s.* should be allowed.

9. Other Manures of more or less unknown Composition.

Under this head may be included—special grass-manures, corn-manures, root-manures, or other compound artificial manures; also dried blood, shoddy, Kainit, ashes, night-soil, soot, other town-manures, sea-weed, fish, and some other refuse-matters.

As in the case of guano, so in that of each of the above manures, the mere price paid for it cannot be accepted as the measure of its value. If any claim for compensation for the unexhausted residue of such manures is to be made, it is absolutely essential that the composition of the manure used should be known.

It is obviously requisite that any Act by which power is given to an outgoing tenant to claim compensation for unexhausted manures should give the person subject to such claim power to ascertain the composition and value of the manures in respect to which the claim is made. In all cases, therefore, in which it is intended to put in such a claim, the person making it should be required to give notice to the landlord that he is about to use certain manures, from which he may have samples taken for analysis if he desire it.

Professor Voelcker in England, the late Professor Anderson in Scotland, and Professor Cameron in Ireland, have from time to time drawn attention to the numerous frauds committed upon tenant-farmers by the sale of spurious manures; and if a purchaser do not take the trouble to protect himself from fraud when his own interest alone is concerned, he is little likely to do so if, by afterwards claiming compensation based upon the amount of his outlay, he can shift a portion of the loss upon some one else.

The value of a manure of this class will depend almost exclusively on the quantity, and the condition, of the nitrogen and of the phosphates, and in the case of Kainit of the potass, which it contains.

Special grass, corn, root, or other compound manures, will

sometimes contain their nitrogen as sulphate of ammonia, but frequently in the form of shoddy, or other nitrogenous organic matter. If the nitrogen exists as sulphate of ammonia it should be valued at the same rate as in that substance. The nitrogen in shoddy, and in most other nitrogenous organic matters used as manure, is, however, much more slowly effective than that in nitrate of soda, sulphate of ammonia, or guano. As a rule, therefore, the nitrogen of manures which exists as nitrogenous organic matter should be valued at only from one-half to two-thirds the price of that in nitrate of soda, sulphate of ammonia, or guano.

A given quantity of nitrogen in nitrogenous organic matter being less rapidly effective, and probably less liable to loss by drainage also, than that in nitrate of soda, sulphate of ammonia, or guano, will of course leave proportionally more for succeeding crops. The result will, however, be so dependent on the description of the organic matter employed, the kind of soil to which it is applied, the characters of the seasons, and other circumstances, and the residue itself would, in some cases, be so slowly available, that, practically speaking, the unexhausted residue from nitrogenous organic matter applied as manure cannot be taken at a higher value in proportion to the original value of the manure settled as above, than in the case of the more rapidly active nitrogenous manures.

The phosphate of manures of this class, if in the state of superphosphate, should be valued as in superphosphate.

The following scale of compensation for unexhausted residue might be adopted when any of these compound artificial manures are used.

When applied to grass, and the produce has been only grazed, 14*s.* for 20*s.* original value of the manure, calculated as above, may be allowed after the first season, 6*s.* after the second, but nothing after the third. If hay be taken and consumed on the farm, the allowance may be 13*s.* after the first year, and 4*s.* after the second year; but if the hay have been sold, only 2*s.* should be allowed.

When applied for a corn-crop, the corn being sold and the straw left, 6*s.* for 20*s.* estimated value of the manure should be allowed. If a second corn-crop be taken no allowance should be made; but if, instead of a second corn-crop, grass or hay be grown and consumed, 1*s.* may be allowed.

When applied for a root-crop, the roots consumed upon the farm, and the manure so produced have not yielded a crop, 12*s.* for 20*s.* of the value of the manure may be allowed if the roots be consumed on the land, or only 10*s.* if consumed in the yards. If a corn-crop has been grown by the manure of the consumed

roots, the grain sold, and the straw left on the farm, 2*s.* for 20*s.* of the estimated value of the manure should be allowed.

Special potass-manures, such as Kainit, are only profitable under such exceptional circumstances as to soil and cropping, that no special rule can be given for the valuation of the unexhausted residue from their use; and before any claim could be admitted, evidence of their utility on the farm in question should be required. When such utility is proved, the same proportion of the original market-value, founded on composition, might be allowed, under the same circumstances as to cropping, &c., as in the case of a mineral superphosphate.

In the case of any compound or refuse artificial manure, containing very little nitrogen, but a fair amount of soluble phosphates, the same proportion of the estimated value of the manure may be allowed for unexhausted residue as if it were a superphosphate. But if it contain very little of either nitrogen or soluble phosphates, no allowance whatever should be made for its use; excepting in the case of a potass-manure under the conditions above defined.

The foregoing remarks as to the circumstances to be taken into consideration in valuing the unexhausted residue of the various compound or refuse artificial manures of more or less unknown or uncertain composition, and the scales of compensation which have been suggested, will, it is hoped, serve as some guide to those who may have to adjudicate on claims made in relation to such manures. At the same time, it will be obvious that, owing to the great difference in the composition and value of such manures, no absolute rules can be laid down for the estimation of the value of any residue they may leave in the soil.

10. Liming, Chalking, Marling, &c.

Liming, chalking, and marling, are practices so far from being generally required, or generally adopted, in agriculture, and their cost and value are so dependent on local circumstances, that no general rules can be laid down for the valuation of their unexhausted effects. Still, where beneficially adopted, they would undoubtedly be fair subjects for compensation if the benefits were not unexhausted at the time of the tenant quitting his holding. If disputed, any claim should be settled upon the evidence, or might appropriately be submitted to the arbitration, of intelligent and disinterested persons of local practical experience.

Such, then, are the results of an attempt, very carefully made, to construct a scale of valuation of the unexhausted residue of

previously-applied manures which have already yielded a crop. It will be observed that a fundamental principle of the valuation is to take as the original value of the manure *not* its *cost-price*, but its properly ascertained *manure-value*. Further, the description of the crop or crops grown since the application of the manure, and whether the produce has been consumed or sold, have carefully been taken into account. But even supposing the estimates arrived at should be admitted or found to be in application as fair as, or fairer than, others in the majority of cases, it is freely granted that they might require very considerable modification, according to the cleanliness or foulness of the land, the lightness or heaviness of the soil, the dryness or wetness of the locality or of the particular seasons, and other circumstances. It is further granted that existing knowledge would not justify an attempt to take these essentially fluctuating conditions into numerical calculation, and to frame a sliding scale of allowances accordingly. Indeed, whatever basis or scale of valuation may be accepted as upon the whole the best, considerable latitude in its application must be allowed to those who may have the responsibility of making the award in individual cases.

The results of the valuation of the unexhausted residue of manures founded on their original *manure-value*, which have been considered in detail in the foregoing pages, are, for the convenience of easy reference and comparison, brought together in one view in Table II. overleaf.

SECTION II.—*Allowances according to the Established Custom of different Counties and Districts.*

The Committee on "Unexhausted Improvements" appointed by the Council of the "Central and Associated Chambers of Agriculture" have sought to collect, and put on record, the particulars of the allowances recognised in different counties and districts for a great variety of feeding-stuffs and manures. Their schedules are arranged for returns relating to linseed-cake, cotton-cake, other purchased feeding-stuffs, guano, nitrate of soda, sulphate of ammonia, nitro-phosphate or blood-manure, special concentrated manures, bone-dust, superphosphate of lime, Kainit, ashes, night-soil, town-manure, rape-cake, soot, sea-weed, fish, and "other fertilisers unenumerated." In their Report, dated June 2, 1874, they state that they have received returns from 55 districts; extending from the most northern to the most southern, and from the most eastern to the most western limits of England. The allowances vary accordingly as the purchased food is consumed in the yards or buildings, on pasture land, or on arable land; or accordingly as the manure is

TABLE II.

Estimated Money-Value of the Unexhausted Residue of Manures remaining after the Growth of different Crops, expressed in Shillings for every Twenty Shillings original *Manure-Value* of the Purchased Feeding-Stuff or Manure employed.

After		Purchased or Saleable Food.	Farmyard, or Town-stable Manure.	Rape-cake, or other Cake used as Manure.	Bones.	Nitrate of Soda.	Sulphate of Ammonia.	Guano, in Natural State, or Manufactured.	Compound Artificial, or Refuse Manures.	Super-phosphate, made from Mineral Phosphates.
	Purchased (or saleable) Feeding-Stuff consumed with Roots, or Manure applied for Roots.									
		Shillings allowable for every 20 Shillings original *Manure-value*.								
1st year	Food consumed with roots on land	17	..	..	..	..	..	..	..	..
1st year	Food consumed with roots in yards	16	..	..	..	..	..	..	..	..
1st year	Manure applied to roots consumed on land	..	17	16	17	15	15	15	12	9
1st year	Manure applied to roots consumed in yards	..	16	15	16	14	14	14	10	8
2nd year	Corn crop; grain sold, straw left	7	9	7	8	4	4	4	2	2
3rd year	Corn crop; grain sold, straw left	1	3	1	2	1	1	1	0	0
3rd year	Grass or hay consumed	2	5	3	4	2	2	2	0	0
4th year	Grass or hay consumed	0	2	0	1	0	0	0	0	0
3rd year	Hay sold	0	2	0	1	0	0	0	0	0

Manure applied for a Corn-crop.

1st year	Corn crop; grain sold, straw left	..	12	7	..	6	6	6	6	5
2nd year	Corn crop; grain sold, straw left	..	6	1	..	0	0	0	0	0
2nd year	Grass or hay consumed	..	8	3	..	1	1	1	1	0
3rd year	Grass or hay consumed	..	4	1	..	0	0	0	0	0
2nd year	Hay sold	..	4	0	..	0	0	0	0	0

Feeding-Stuff consumed on, or Manure applied to, Grass-land—Grazed.

1st year	Grazed	18	18	..	18	16	16	16	14	12
2nd year	Grazed	12	14	.	13	10	10	10	6	4
3rd year	Grazed	4	8	..	6	2	2	2	0	0
4th year	Grazed	0	2	..	1	0	0	0	0	0

Feeding-Stuff consumed on, or Manure applied to, Grass-land—Hay consumed.

	No crop	18	..	..	..	..	..	..	..	..
1st year	Hay consumed	11	16	..	16	14	14	14	13	10
2nd year	Hay consumed	2	12	..	10	8	8	8	4	2
3rd year	Hay consumed	0	6	..	3	1	1	1	0	0
4th year	Hay consumed	0	0	..	0	0	0	0	0	0

Feeding-Stuff consumed on, or Manure applied to, Grass-land—Hay sold.

	No crop	18	..	..	..	..	..	..	..	..
1st year	Hay sold	2	10	.	10	2	2	2	2	0
2nd year	Hay sold	0	4	..	4	0	0	0	0	0
3rd year	Hay sold	0	0	..	0	0	0	0	0	0

applied to root or green-crops consumed on the farm, to corn-crops, the straw being left for consumption, hay-crops consumed on the farm, or to pasture; and accordingly, also, as the food or manure was employed in the last year, or the last year but one, of the tenancy.

In all cases the allowance is expressed as a certain *proportion of the "original value"* of the purchased feeding-stuff or manure; "original value" meaning, it would appear, original *cost* of the article.

It is understood that in some of the most important of the agricultural districts to which the returns refer, the scale of compensation has been settled by the mutual consent of outgoing and incoming tenants; and some of the advocates of compulsory compensation seem anxious that certain of the customs in question should be extended to all parts of England. It seems very desirable, therefore, that the basis of a few of the most important of the recognised allowances should be carefully considered, and their results compared with those arrived at by other methods of valuation.

In the most important districts in which such customs are in force, and which are supposed to supply the best examples for application to other localities, it so happens that there exists a very rigid, or scarcely varying, rotation of crops, and that little else than one or two standard feeding-stuffs, and one or two standard manures, are used. Supposing, therefore, the basis of the allowances prevailing in those districts were to be adopted for the country at large, the list, and the conditions, would have to be greatly enlarged if the requirements of the farming under the great variety of rotations, and with the great variety of foods and manures employed, in other districts, are to be provided for.

Of the returns in question, Schedule 1, Form B, apparently in an incomplete state, is the only one I have been able to obtain. From it I find that in Lincolnshire, and in some other districts, the allowance for purchased feeding-stuffs is one-half the original value of the quantity consumed by the outgoing tenant during the last year of his occupancy, a condition being that that quantity be not excessive; and it is the same whether the food have been consumed in the yards, on pasture, or on arable land.

The following Table shows, in parallel columns, the present price per ton of some staple feeding-stuffs, and the allowance to the outgoing tenant for its consumption, according to the customs referred to, founded on "original value" or cost. By the side of these is also shown the allowance that would be made according to the scale of valuation laid down in the foregoing Section (I.); in the construction of which the original *manure-*

value of the feeding-stuff after consumption, as given in the Table at page 11, is adopted as the basis, and it is assumed that the quantity of the feeding-stuff accepted as the year's consumption is the average amount of two, three, or more years, as the case may be, and the allowance is made on a declining scale from year to year, according to the crop grown, &c., as already fully explained.

	One Ton of Food Consumed per Annum.			
	"Original value" or Purchasing Price.	Allowance according to Lincolnshire Custom; half One Year's Consumption.	Allowance according to Manure-value; on Three Years' Consumption.	Allowance by "Custom" more (+), or less (−), than by "Manure-value."
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Cotton-cake, decorticated ..	10 10 0	5 5 0	8 5 9	− 3 0 9
Linseed cake ..	12 10 0	6 5 0	5 17 11	+ 0 7 1
Wheat	9 10 0	4 15 0	2 2 1	+ 2 12 11

Although, according to the Lincolnshire custom, the allowance is half the original value of the last, or one year's consumption only, it is a condition that the quantity claimed upon shall only be a fair average of the consumption of three years: so that, in point of fact, the allowance, though only part of one year's consumption, is, as in the case of my own scale, arranged to compensate for more than the consumption of the last year alone. In the case of my own scale, 17*s.* is allowed for every 20*s.* of original "*manure-value*" of the food if consumed on the land during the last year, and 16*s.* if consumed in the yards; and in the example given in the Table, it is supposed that half is consumed on the land, and half in the yards; 7*s.* in 20*s.* is allowed for the amount consumed with roots in the last year but one, followed by a corn-crop; and 2*s.* for the amount consumed in the last year but two, followed by corn, and this by grass or hay consumed.

Of all purchased feeding-stuffs, linseed-cake is the one in the use of which farmers have the greatest experience, and the feeding and manure-value of which are therefore the best understood. It will be seen that the allowance for it is, according to the Lincolnshire custom, nearly the same as according to my more elaborate scale; and the agreement would be nearer still, if it were not that the cost of the cake is taken at the present exceptionally high price.

It is, however, when we come to other purchased feeding-stuffs, the feeding and manure-value of which is less understood, but in respect to which the allowance for compensation is, like that for linseed-cake, also based upon *original cost*, that we find very wide differences between the allowance according to the "customs," and according to *manure-value*. Thus, in the case of decorticated cotton-cake, which has not only the highest manure-value of any of the articles enumerated in the Table at page 11, but has also a very high manure-value in proportion to the purchasing price of the food, my estimate of unexhausted residue, founded on manure-value, is very much higher than that which would be allowed by the Lincolnshire custom. In the case of wheat, on the other hand, which has a very low manure-value, both actually and relatively to purchasing price, the allowance founded on *manure-value* would be considerably less than half that according to the Lincolnshire custom, founded on *original cost.*

These few examples are sufficient to show how entirely fallacious it is to assume that the manure-value of a food, whatever may be its composition, bears a fixed proportion to its original cost. It may, perhaps, be answered that my own estimates are erroneous; and certainly I do not intend to claim for them infallibility, but only that they are carefully made, with due regard to such knowledge as at present exists bearing upon the subject.

But let us test the question in another way. Wheat is much used for feeding at the present time, and the purchasing price of feeding qualities may be taken at 9*l.* 10*s.* per ton. On the assumption that the manure-value of any feeding-stuff is one-half its purchasing price, that of a ton of wheat after consumption would be 4*l.* 15*s.* Now, the manure-value of consumed food may be said to depend almost exclusively on the amount of nitrogen, phosphoric acid, and potass, contributed to the manure; and the quantity of these constituents yielded by the consumption of a ton of wheat would be, in round numbers:—

	lbs.
Nitrogen	34
Phosphoric acid, reckoned as phosphate of lime	40
Potass	11

These manurial constituents could be purchased at the present time as follows:—

	£	s.	d.
34 lbs. nitrogen, in 220 lbs. nitrate of soda, at 14*s.* per cwt...	1	7	6
40 lbs. phosphate of lime (soluble), in 154 lbs. superphosphate, at 5*s.* 6*d.* per cwt.	0	7	6
11 lbs. potass in 22 lbs. sulphate of potass, at 16*s.* per cwt. ..	0	3	2
	£1	18	2

Thus, then, if wheat had been consumed, and compensation were allowed at the rate of one-half the original cost of the year's consumption, the incoming tenant would have to pay nearly 3*l.* more for each ton of wheat so used by his predecessor than the constituents he received in the manure could be purchased for in artificial manures. Not only so, the animal-manure would be subject to an unknown loss by winter rains, and would be less rapidly active than the same constituents applied in artificial manures in the spring.

Further, the allowances according to "Custom" vary very much in different localities, and even in closely-contiguous districts. Thus, within the limits of the West Riding of Yorkshire, in one district the allowance on the last year's consumption is one-half or one-third of the original value of the food, according to the description of the cake, or the conditions under which it has been consumed; and, for the last year but one, one-fourth the original value in all cases. In another district the allowance is, for the last year one-fourth, and for the last year but one one-eighth, under all conditions. In a third, it is for the last year one-third, and for the last year but one, nothing.

In South Staffordshire the allowance for linseed or cotton-cake consumed is, for the quantity used during the last year of the tenancy, two-thirds, and for that used during the last year but one, one-third, of the original value of the food. Supposing the outgoing tenant consumed 1 ton of linseed-cake annually upon his turnip-crop, followed by barley, he would receive compensation, according to the custom of South Staffordshire, founded on original value or *cost*, and according to my estimates, founded on *manure-value*, respectively, as follows:—

According to South Staffordshire custom—

	£	*s.*	*d.*	£	*s.*	*d.*
1 ton linseed cake, last year, two-thirds cost, at 12*l.* 10*s.*	8	6	8			
1 ton linseed cake, last year but one, one-third cost, at 12*l.* 10*s.*	4	3	4			
				12	10	0

According to my estimate of manure-value—

	£	*s.*	*d.*	£	*s.*	*d.*
1 ton linseed cake, last year, consumed with roots on land	3	18	8			
1 ton linseed cake, last year but one, fed with roots on land, followed by barley	1	12	4			
1 ton linseed cake, last year but two, fed with roots on land, followed by barley, and by grass or hay consumed	0	9	3			
				6	0	3
				£6	9	9

Here, then, for every ton of linseed-cake annually consumed by his predecessor during the last years of his occupancy the incoming tenant would, according to the South Staffordshire custom, have to pay 6*l.* 9*s.* 9*d.* more than according to the estimate founded on manure-value, in fact more than twice as much.

In the following Table are compared the compensation that would be allotted according to the Lincolnshire custom, founded on original cost, and according to my estimates founded on composition or manure-value, for guano containing nitrogen equal to 13 per cent. ammonia, for guano containing nitrogen equal to 6·5 per cent. ammonia, for nitrate of soda containing nitrogen equal to 19 per cent. ammonia, for sulphate of ammonia containing 24 per cent. ammonia, and for superphosphate of lime containing 26 per cent. phosphate rendered soluble. Each is supposed to be applied for a root-crop consumed by the outgoing tenant during the last year of his occupancy.

	One Ton used per Annum for Roots consumed.											
	Original value, or Purchasing Price.			Allowance according to Lincolnshire Custom.			Allowance according to scale at Page 24.			Custom allowance more (+), or less (−), than according to scale at Page 24.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Guano containing nitrogen = 13 per cent. ammonia ..	13	0	0	13	0	0	9	15	0	+3	5	0
Guano containing nitrogen = 6·5 per cent. ammonia.	13	0	0	13	0	0	4	17	6	+8	2	6
Nitrate of soda containing nitrogen = 19 per cent. ammonia	14	0	0	14	0	0	10	10	0	+3	10	0
Sulphate of ammonia containing 24 per cent. of ammonia	18	10	0	18	10	0	13	17	6	+4	12	6
Superphosphate of lime containing 26 per cent. soluble phosphate	5	10	0	5	10	0	2	15	0	+2	15	0

Again, in regard to manures, as to many feeding-stuffs, the compensation for unexhausted residue is much higher according to the Lincolnshire custom than according to my estimates. The illustration given of guano supposed to contain 13 per cent., or only 6·5 per cent. of ammonia respectively, each bought at the uniform price of 13*l.* per ton, shows how fallacious is the estimate of unexhausted value founded on original cost, instead of on composition.

The examples given in respect to both feeding-stuffs and manures, of the great and variable difference in the amount of compensation that would be awarded for unexhausted residue according to the customs of large agricultural districts on the one hand, and on the basis of valuation according to composition on the other, are, to say the least, very striking. Little doubt can be entertained, that much better evidence of their fairness and general applicability than at present exists would be required before attempting to apply the scale of allowances adopted in special agricultural districts to the country at large.

I am quite willing to grant that wide differences exist between the soil, climate, and other conditions of the agriculture of other districts, compared with those of my own farm. Indeed, although I cannot admit that the experimental results obtained at Rothamsted afford no data upon which, with care and judgment, important general conclusions applicable to other and different conditions may be founded, yet I have already said that, even supposing the basis upon which my own estimates of compensation are arranged were adopted, the exact scale of allowances might require considerable modification, according to the characters of the soil, of the climate, of the individual seasons, and other circumstances.

It will, perhaps, be said that so long as both parties interested agree to accept terms of compensation, which, whether fair or not, those subject to them may at some future time in their turn exact, no great harm is done. But in the event of a system of compulsory compensation being adopted, proof of the value of the unexhausted residue of feeding-stuffs and manures will be required of the claimant; and I would ask—where are the scientific witnesses, having characters to lose, who would assert that the unexhausted residue from all purchased feeding-stuffs and manures may be valued on the basis of the original value or purchasing price of the article?

SECTION III.—*Estimation of Compensation for the Unexhausted Residue of purchased (or saleable) Feeding-stuffs and Manures, by the Valuation of what is above ground, and has a recognised and easily-ascertainable Money-value.*

I freely admit that the tenant farmer has an equitable claim for compensation for the unexhausted manures he leaves in the soil when he quits his holding. But I think anyone who has carefully considered the schemes of compensation discussed in either of the foregoing Sections (I. and II.) of this Paper will agree with me that, even with the best intention, and calling to our aid all the knowledge, both practical and scientific, which

we at present possess bearing upon the subject, it would be a matter of very great difficulty to lay down rules which shall be generally applicable for the estimation of the productive, and consequently of the money-value of the unexhausted residue of manures which have previously been applied to the soil, and have already yielded a crop.

The results of direct experiments have shown that some important constituents of manure either leave little or no unexhausted residue in the land after the first crop, or leave it so combined within the soil, or so distributed throughout it, that it produces little or no appreciable effect on succeeding crops. Some manures, on the other hand, produce marked effects for several years after their application. It is obvious, therefore, that it would require a very complicated sliding-scale to enable us to estimate the value of constituents already under ground under the very varying conditions that would arise, as to the description and the amount of the manure employed, the characters of the soil and subsoil, the dryness or wetness of the particular locality or of particular seasons, the description of crop grown, the cleanliness or foulness of the land, and so on.

It seems extremely desirable, therefore, that every attempt should be made to arrive at some mode of estimating the compensation due to an outgoing tenant for his unexhausted manures founded on the valuation of what is above ground, the amount and the value of which can be easily ascertained, rather than to leave his claims to be settled by the conflicts of practice and science in Courts of Law. Tenant-farmers would find an Act for compulsory compensation dearly bought on such terms.

In my Paper read before the London Farmers' Club, in April, 1870, I made some suggestions with a view of estimating compensation by the valuation of certain products of the farm. These, with some modifications, I propose to re-state here, in the hope that they will, at any rate, receive that full and candid criticism without which the principle they involve should be neither accepted nor rejected.

If the plan in question were adopted, it would be desirable that the time of entry should be Lady-day. The items upon which I would base the valuation in favour of the outgoing tenant are,—

1. The farmyard-manure made during the last six months of the occupancy.

2. The manure from the consumption of purchased food which has not yet grown a crop.

3. The straw of the corn-crops of the next harvest.

The farmyard-manure would be valued to the incoming tenant by the load or ton. The price of the dung, per load or ton, would

have to be settled, either by agreement, or by a recognised custom for a given district or locality; and the question is open for consideration whether the rate should approximate to the farm- or to the market-value. As the quantity of dung to be so valued will depend very much on the quantity of straw produced at the last harvest, the valuation will, so far, take into account the previous condition of the land. High condition of land means large corn-crops, and the tendency of the effect of high manuring is to increase the straw in greater proportion than the corn; and as 1 ton of straw makes from $3\frac{1}{2}$ to 4 tons or more of dung, the difference between the number of tons of dung paid for on entry on land in poor condition, and the amount to receive for on quitting in high condition, may be very large.

If in addition to the value of dung, reckoned per load or ton, the manure-value of the purchased food, if any, consumed in its production were also allowed, it might be objected that the incoming tenant would thus have to pay for the same manure twice over. In answer it may be said that the addition to the weight of a yard of manure by the excrements due to the consumption of purchased food is comparatively immaterial; but if it were decided that a reduction should be made on this score, about three-fourths of the weight of the purchased food would probably be sufficient to deduct from the total number of loads or tons of dung. What proportion of the original manure-value of the purchased food, as shown in Table I., at page 11, should be allowed, will depend upon whether it has been consumed on the land, or in the yards or buildings. If on the land 17*s*., and if in the yards or buildings 16*s*., for every 20*s*. of original manure-value should be allowed.

The condition of the land in regard to recent manuring would, as in the case of the amount of dung produced from the straw of the last harvest, be further represented in the amount of straw to be valued as such at the next harvest. How much the amount of straw may vary on the same land and in the same seasons, according to "condition," may be illustrated by what is, however, admittedly a very extreme case. The continuously unmanured plot in my experimental wheat-field gave over a series of years an average of only about $14\frac{1}{2}$ cwts. of straw per acre; whilst a highly-manured plot gave, over the same period, an average of $46\frac{1}{2}$ cwts., or nearly $3\frac{1}{4}$ times as much.

Supposing the amount of straw were to be taken as an item in the valuation for compensation, as here proposed, the question whether the consuming or the market price should be adopted would, as in the case of the dung, be still open for consideration.

Shortly after the publication of my Paper read before the London Farmers' Club in 1870, Mr. Smith, of Woolston, writing

in the 'Agricultural Gazette,' objected, first, that my plan of compensation would give the outgoing tenant nothing more than the consuming value of his straw, and afterwards, that it would give him no more than he could already obtain. Neither allegation was true. The real question at issue is, however, not whether on the plan proposed the outgoing tenant would receive less or more than under any other arrangement, but whether he would receive as much as he was entitled to for his outlay. In answer, I put as an example a case which, with some modifications, I repeat here.

Suppose a farm of 400 acres cultivated on the four-course system; that the tenant enters upon it in a low condition; that after years of clean farming, and the liberal use of purchased food and manures, he leaves it in high condition; and that, accordingly, it yielded at the time of entry, and the time of giving up, respectively, the following average amounts of produce.

	Average Produce per Acre.	
	On Entry.	On Leaving.
100 acres roots	6 tons.	12 tons.
100 acres barley	28 bushels.	42 bushels.
100 acres hay	1 ton.	2 tons.
100 acres wheat	24 bushels.	36 bushels.

It will be unnecessary to complicate the subject by taking into account the oats consumed by the horses, as the amount of manure produced from them would not be materially different at the two periods. Also for the sake of simplicity, the same proportion of straw to corn may be assumed on entry and on leaving, though it would doubtless be higher under the improved condition. Let it be assumed, then, that in each case half the roots are consumed in the yards; that previous to entry no purchased food had been employed; that during the later years of the occupancy 25 tons of linseed-cake were used annually; that for every bushel of wheat (of 60 lbs.) there was an average of 100 lbs. of straw, and for every bushel of barley (of 52 lbs.) an average of $62\frac{1}{2}$ lbs. of straw.

Adopting these data, the following are the amounts of straw, and the estimated amounts of dung, entered upon, and left, respectively; and the difference between the value of these on entry and on leaving, together with the proportion of the manure

value of the purchased cake, will represent the compensation to be received by the outgoing tenant for his improvement of the condition of the land.

First, as to the straw, we have—

	Wheat Straw.	Barley Straw.	Total Straw.	Value at 15*s.* per ton.
	Tons.	Tons.	Tons.	£ *s.* *d.*
On entry	107	78	185	138 15 0
On leaving	160½	117	277½	208 2 6
Difference	53½	39	92½	69 7 6

Reckoning the same amounts of straw as above assumed on entry, to have been converted into manure during the season previous to entry; and again, the same amounts as assumed on leaving, to have been converted into manure during the season previous to leaving; with, in each case, the consumption of roots and hay as above supposed, and previous to leaving of 25 tons of linseed-cake also, the amounts of manure, calculated according to carefully considered data would be about as follows:—

	Fresh Dung.	Value at 5*s.* per ton.
	Tons.	£ *s.* *d.*
On entry	649	162 5 0
On leaving	1072	268 0 0
Difference	423	105 15 0

Lastly, the estimated total *manure-value* obtained by the consumption of 1 ton of linseed-cake is 4*l.* 12*s.* 6*d.*; and assuming that the outgoing tenant consumed 25 tons, half on the land and half in the yards, he would have an average claim of 16*s.* 6*d.* for every 1*l.* of original or total manure-value of the 25 tons of cake. The original manure-value of 25 tons of linseed-cake would be 115*l.* 12*s.* 6*d.*; and this at 16*s.* 6*d.* in the 1*l.* would be 95*l.* 7*s.* 10*d.*, due to the outgoing tenant on the consumption of the 25 tons of linseed-cake during the last year of his occupancy.

The outgoing tenant would, therefore, according to the above estimates, founded on the amount of certain products of the farm, the quantity and value of which are easily ascertained, receive

as compensation for his unexhausted improvement in the condition of the land, the following sums beyond what he paid on entry:—

	£	s.	d.
On straw	69	7	6
On dung	105	15	0
On purchased food consumed	95	7	10
	£270	10	4

As I said at the time, so I repeat now, whether the above amount would or would not be adequate compensation is a question fairly open for discussion. I do not at all insist on the general applicability of the rate of 15*s.* per ton for the straw, or of 5*s.* per ton for fresh dung, adopted above for the purpose of illustration. All I contend for is the principle of valuation which I have proposed: being convinced that valuations so made would rest upon a basis of facts much more easily ascertainable, and much more trustworthy, than would any estimates of the value of the unexhausted residue of manures which have been applied to the land, and have already yielded a crop.

For comparison, there is shown below what would be the allowance in the case of a 400-acre farm as above assumed:—

1. According to the scale laid down in Section I., founded on *manure-value.*

2. According to the Lincolnshire custom, founded on *cost,* as quoted in Section II.

3. According to the valuation of the straw, of the dung, and of the manure from purchased food, as given above:—

	£	s.	d.	£	s.	d.
1. According to *Manure-value*—						
25 tons linseed-cake, last year, consumed with roots, half on land and half in yards	95	7	10			
25 tons linseed-cake, last year but one, consumed with roots, followed by corn	40	9	5			
25 tons linseed-cake, last year but two, consumed with roots, followed by corn, and hay consumed	11	11	3			
				147	8	
2. According to *Lincolnshire custom*—						
25 tons linseed-cake consumed during last year, half original value	..			156	5	
3. Calculated on produce, &c.—						
On straw	69	7	6			
On dung	105	15	0			
On purchased food consumed	95	7	10			
				270	10	

Thus then, in the case supposed, the outgoing tenant would be awarded almost identical amounts of compensation for the unexhausted residue of his purchased linseed-cake, whether it were estimated according to my more elaborate mode of valuation founded on *manure-value*, or whether according to the Lincolnshire custom, founded on original value or *cost*; and the agreement would be closer still if, in the latter calculation, the present exceptionally high price of linseed-cake had not been adopted. As already pointed out, however, although in the case of linseed-cake, the food and manure-value of which are comparatively well understood, these two methods do give closely approximating results, yet, as has been shown, they lead to totally different estimates with other foods of different composition, and which have been less generally used.

Compared with either of the two methods just referred to, the valuation founded on the amount of dung made from the straw of the preceding harvest, the amount of purchased food consumed, and the quantity of straw of the succeeding harvest, is seen to give a very much higher rate of compensation. It is to be observed, however, that whilst in the case of method 1, or method 2, being adopted, further allowances would frequently be made for straw and dung, in the case of method 3 the allowance for these is already included.

With the foregoing consideration of the principle and results of the different methods, and with the example given of the application of each, put forward merely for the sake of illustration and comparison, I leave the further discussion of this complicated and difficult subject to those whom it may most concern, feeling assured that I may safely do so at a time when the important questions involved are exciting so much general interest.

It may be said that the adoption of the plan of valuation I have proposed, founded on the amount and value of certain products of the farm, would necessitate an entire re-arrangement of covenants and customs. This may be true; but I would suggest whether the changes required under such circumstances would be greater than would be forced upon the landlord, if compulsory compensation on any other basis became the law of the land?

The main conclusions arrived at may be summarised as follows:—

1. In the existing state of our knowledge, no simple rules, applicable to various soils and subsoils, climates, seasons, crops, and manures, can be laid down for the valuation of the unexhausted residue of previously applied manures which have already yielded a crop.

2. Under such circumstances, valuation upon such a basis would very frequently result in injustice to the one party or the other, and would probably lead to much litigation.

3. If a system of compensation based upon the valuation of the unexhausted residue from purchased foods or manures were adopted, power should be given to the landlord, or to the incoming tenant, to take samples for analysis, of any foods or manures, for the use of which any claim is to be made.

4. In consideration of the difficulties attending other methods of valuation, it is very desirable to consider whether compensation for unexhausted condition of land might not be advantageously based upon the amount of certain products of the farm, the quantity and money-value of which can be easily ascertained.

II.—*Report on Messrs. Prout and Middleditch's Continuous Corn Growing.* By Finlay Dun, Weston Park, Warwickshire.

Some agricultural authorities insist that corn growing cannot pay in England, and that the increasing expenses of cultivation must shortly consign large tracts of arable land to grass. Whether supported mainly upon permanent pastures or upon fodder and roots grown under rotation, cattle and sheep have recently been regarded as the chief sources of farm profits. They have moreover been considered essential for maintaining the condition alike of grass and arable land. Indeed good yard-manure and sheep penning, with occasional cleaning and recruitment by fallow and grass, have hitherto been the recognised means of maintaining the fertility of ploughed land. Accepting these data, good managers of clay soils have recently endeavoured to augment their herds and flocks, to grow mangold and other food for stock, to increase their expenditure upon cake and corn, and fatten sheep as well as cattle in yards. Steam economically securing deeper and more thorough cultivation in some localities is superseding the slower and more expensive horse-power. But despite these aids and modern appliances, the heavy clays continue, too generally, to absorb a large amount of capital and yield a minimum of profit. Owners and occupiers are alike dissatisfied with the meagre returns obtained from clay farms, and anxiously invoke the aid of science and practice.

Two spirited agriculturists, Mr. John Prout, of Sawbridgeworth, Herts, and Mr. Edward Middleditch, of Blunsdon, Swindon, Wiltshire, have helped materially to solve some o[f] the difficulties of clay farming. They have demonstrated mor[e]

fully the agricultural capabilities of stubborn clays; have practically shown how successfully they may be cultivated; have profitably grown cereals on the same heavy land for several consecutive years, and continue annually to dispose of the whole of the increased produce. The Council of the Royal Agricultural Society of England, desirous that such striking results should be investigated and made public, have instructed me to prepare a report on these two interesting farms.

Mr. Prout purchased Blount's and Sweetdew's farms, in 1861. They comprise 450 acres, situated in the parish of Sawbridgeworth, about four miles from Harlow, and four miles from Bishop Stortford. The soil—a clay and strong loam readily poaching and running together if worked wet—lies upon a subsoil of drift-clay and cretaceous gravel, a portion of the Eocene formation, and bordering on the Chalk and chalk-marl. Subjoined* are analyses made, in 1865, by Professor Voelcker, of the soil from three fields, carefully collected by himself, and showing no remarkable fertility, and no superabundance of the alkalies and phosphates, which grain-crops specially require. The property, when conveyed to Mr. Prout thirteen years ago, had for some time been in the market, had frightened various intending purchasers, and eventually was bought for 33*l.* per acre,—a moderate cost for a compact estate in a beautiful metropolitan county, and only twenty-eight miles from London. But to such an indifferent condition had the farm been reduced, that the former owner had difficulty in getting a tenant to offer 20*s.* per acre.

The land was wet, overrun with couch, docks, and thistles, and overshadowed with crooked useless fences. Even the fields

* Analyses of Soils at Blount's Farm.

	Broad Field.	Black Acre.	White Moor.
	Per Cent.	Per Cent.	Per Cent.
Organic matter	4·75	4·46	5·49
Oxide of iron	4·80	4·29	7·91
Alumina	5·39	4·90	2·06
Carbonate of lime	2·45	4·74	1·80
Magnesia	1·84	1·59	0·80
Potash	0·54	0·72	0·51
Soda	0·08	traces.	0·16
Sulphuric acid	0·08	0·01	0·09
Phosphoric acid	0·16	0·12	0·27
Insoluble matters	79·91	79·17	80·91
	100·00	100·00	100·00
Sand by washing	53·01	42·64	39·38

around the house, presumably in the best condition, produced the miserable yield of 12 bushels of wheat, and 20 of oats in the year that Mr. Prout took possession. As might be anticipated, a heavy outlay was required before much return could be drawn from such a property. About 16*l.* per acre was expended in draining, cutting outfall ditches, grubbing up and levelling old fences, making roads, adding to and repairing buildings, and fallowing foul land. Mr. Prout as well as his son, Mr. William Prout, have, most obligingly, given me much information relating to their improvements and farming, and furnished me with the following details of the cost of these preliminary improvements:—

	£		£
Draining	2700	or per acre	6
Ditches and fences	450	,,	1
Roads, reservoirs and pumps	900	,,	2
Cottages, luncheon-room and walls ..	450	,,	1
Bare fallows and cleaning	2700	,,	6
	£7200	,,	16

The old farm-house, barns, and yards stand rather towards the northern boundary of the farm. A new house has been talked of, but Mr. Prout, when he makes his frequent visits, is still content with the accommodation furnished by several rooms in the old dwelling, permanently occupied by the bailiff. But, solicitous for the comfort and convenience of his labourers, he has built and improved three commodious cottages. The home barns, chiefly constructed of wood, and thatched, being of little use for the storage of corn, are converted into spacious, airy, loose boxes for the cart-horses. An outlying barn is employed as a manure-shed. To ensure convenient water-supply, new wells have been dug and old ones cleaned out. In one enclosure, where the water frequently wept forth, stunting or destroying every crop, a brick reservoir, capable of containing 15,000 gallons of water, has been made; and into this is fixed, handy to the road, an elevated iron pump, under which the water-carts supplying the engine are conveniently filled. A great deal of labour and several hundred pounds were expended in grubbing up the unsightly hedge-rows, and levelling the ugly banks, which cut the farm into fifty-one enclosures. Laboriously with horses this reclaimed land was ploughed, and brought into good cultivation; and it now adds about 18 acres to the productive area of the farm.

The land, gently sloping, lies tolerably well for draining, but the former outfalls were indifferent; the bush-drains, which, as elsewhere in the locality, had been dug in some of the wettest places, did little good; and, in spite of ridging up in narrow

3-ft. lands, the miserable crops were often starved. At intervals of 33 yds. 2-in. pipes were laid at the depth of $3\frac{1}{2}$ feet; in the lower portions of the longer drains 3-in. pipes were placed; the pipes in the furrows empty into 4 or 6-in. mains which collect the drainage of 10 or 12 acres, and discharge into dykes or ditches 6 or 7 ft. deep, which intersect the symmetrical fields and conduct the surplus water into a tributary of the Lea. About 70 acres were drained, at 14 ft. intervals and 28 in. depth, by the steam mole-ploughs of Mr. Eddington, of Chelmsford; this cost 35*s.* per acre, with 5*s.* extra for digging and laying the mains by hand labour. But most of this land, thus steam-mole drained, has since required to be dried in the ordinary way with pipes. Fifteen acres were drained to the depth of 4 ft., but as the argillaceous substratum is cut through and the yellow clay reached at $3\frac{1}{2}$ ft. there appears no good reason for deeper and more expensive draining. No difference is observable in the dryness of the fields drained at $3\frac{1}{2}$ and 4 ft., nor has repeated observation discovered any difference in the outflow of water from the same acreage drained at these two depths. The dykes, 6 to 7 ft. deep, and wide in proportion, present rather a formidable obstruction during the hunting season, but effectually separate the twenty enclosures into which the farm is now divided.

Convinced of the economy of steam for the working of heavy land, Mr. Prout at once obtained, from Messrs. John Fowler and Co., of Leeds, a 14-horse-power engine with clip-drum, anchor, and 400 yards of rope for 1065*l.* This tackle, the best that was then procurable, has been very effective, is still in admirable order, and enables him to get through his work with six or seven horses. Even during earlier years ten horses sufficed to perform the farm work as well as the haulage of draining-pipes, road materials, and other extra duties. The steam cultivation at Sawbridgeworth has already been described in the Society's 'Journal,' Second Series, vol. iii. p. 121. The importance of the service, so economically rendered by the steam-tackle, may also be gathered from the subjoined tabular statement, extracted for me from his books by Mr. William Prout.

This Table (p. 42) indicates the reiterated operations which were at first essential to clean the foul land. But instead of the two or three ploughings and a scarifying at first requisite, one operation, generally a ploughing 6 or 7 inches deep, now suffices to ensure a good and clean seed-bed. The whole of the farm has been subsoiled 15 or 16 inches deep, but another such subsoiling will probably shortly be undertaken. So effectually did the steam-tackle disintegrate the formerly sour stiff clay, and admit frost, air, and sun, that for a few years full crops throve with little extra manuring, and even consecu-

tive cereals were grown with about 20*s.* per acre of artificial manure. Experience, however, has shown that to prosecute successfully Mr. Prout's system, fertilisers to the value of 50*s.* or 60*s.* per acre require to be applied annually.

Years.	Subsoiled.	Ploughed.	Scarified.	Total.
	Acres.	Acres.	Acres.	Acres.
1862 and 1863	277	1401	480	2158
1864	191	409	264	864
1865	98	496	317	911
1866	..	310	..	310
1867	..	637	174	811
1868	..	321	257	678
1869	..	368	116	502
1870	..	281	277	558
1871	..	296	130	426
1872	57	304	55	416
1873	..	363	4	367
1874	..	408	..	408
	623	5612	2074	8309

But Mr. Prout has done more than bring into superior and profitable cultivation 450 acres of heavy clay land, thirteen years ago worth not more than 20*s.* per acre. He has inaugurated an almost original system of husbandry. Cereals and clover are year after year sold to be removed from the occupation; all ordinary rotations are ignored; corn-crops follow each other on the same field for several consecutive years; wheat has been taken for five years following; cereals have been reiterated for eight years. For his consecutive corn-crops Mr. Prout only desires deep thorough cultivation, extirpation of weeds, and the regular supply of plant-food in the form of appropriate portable manures. His present system was not adopted hastily and inconsistently. Mr. Prout is no mere theorist. He brought to Sawbridgeworth abundant experience, acquired in farming both in Cornwall and Canada, and for the first few years endeavoured to farm on established principles, to pursue some well-advised rotation, to keep and feed plenty of live stock, to increase fertility by the purchase of London manure. But, like some other agriculturists, he found that he could not make a satisfactory balance-sheet. Messrs. Lawes and Gilbert's successful experiments at Rothamsted in growing grain-crops in consecutive years with artificial manures, justified, he believed, the more extensive adoption of this system; and he determined to sell year by year the whole of his growing-crops, and to restore an equivalent of plant-food in the form of portable fertilisers. Accordingly in 1864, 147 acres of

wheat, 73 acres of barley, and 29 acres of oats, were advertised for sale, straw as well as grain to be removed. An average of 8*l.* 8*s.* per acre was obtained. Eight sales have since followed. Prices have varied with the season and the prospects of the market, but reached their highest in 1870, when the total average was 12*l.* 6*s.* 6*d.*, the wheat making 15*l.* 3*s.* 10*d.* The sale account for 1874 is as follows:—

			£	*s.*	*d.*		£	*s.*	*d.*
325	acres	Wheat, averaging	10	17	7	=	3536	2	6
64	,,	Oats, averaging	9	15	0	=	624	0	0
45	,,	Clover cut and ricked, averaging	7	2	3	=	320	1	3
..	,,	Aftermath	3	5	9	=	147	18	9
434	,,	.. .. Averaging	10	13	3	=	4628	2	6

The sales are held a week or ten days before the crops are ready for harvest. The neighbouring farmers are the principal buyers, and at the sale of 1874 one gentleman bought 54 acres. The purchasers usually superintend their own harvesting, thresh out their own grain, part of it from the field, most of it before Christmas, and either consume the straw or forward it to London. Metropolitan dealers sometimes compete for the hay. Comfortably to accommodate the increasing company annually attracted to the sales, Mr. Prout, in 1866, provided over his cart-shed a spacious apartment in which a capital cold collation is served before the party proceed to the fields. The crops are set out in lots, usually varying from 5 to 15 acres, each lot being conspicuously marked by a pole, surmounted with a board, on which the printed number is affixed. Competition is generally good, and few lots fall below the moderate reserve placed upon them. Removal of number-boards or other mistakes seldom occur; rarely is a purchase repudiated. Six months' credit is given; the auctioneer will probably not object to its being recorded that he receives for his services 4 per cent., that he pays advertisements and meets bad debts, which are neither numerous nor serious. After harvest Mr. Prout has the pieces measured, and half this expense is paid by the purchasers. The total cost of the sale, including auctioneer's commission, lunch, &c., is set down at 200*l.* Although the "lot is at the risk of the purchaser at the fall of the hammer," Mr. Prout does not cease to take an interest in his fine crops. He finds reaping-machines and horses at moderate cost to cut down the thinner crops; his barns and out-houses for five or six weeks are filled with Irish and other harvest-hands, sometimes to the number of 120, a large proportion of them from London. They generally prove themselves well-disposed steady work-people, and receive from 12*s.* to 15*s.* per acre for fagging, and about 6*s.*

for tying-up and shocking behind the machines. So well satisfied are these town denizens with their trip to the Hertfordshire hills that they usually return annually, close the while their town house, and bring their families, three of which last year reached the goodly number of ten each, and are generally conveyed, with their scanty baggage, in donkey-carts. Harvest got-in, these labourers change their country quarters, and frequently have several weeks' hop-picking in Kent.

I inspected Mr. Prout's farm during the first week of last August, just as harvest operations begun. Compared with most holdings throughout the Midland counties, and even with many in neighbouring parts of Hertfordshire, Blount's Farm exhibits a paucity of trees and hedge-rows. There is no permanent grass, a very limited area of green crops, and no live stock excepting a couple of Guernsey cows, six agricultural horses, a carriage-horse, and a pony. Wheat is the staple produce, generally occupying upwards of 300 acres. In 1874 there were grown 216 acres of Payne's Rivett, a description of cone wheat, and 103 acres of Browick red—two varieties which have been proved by repeated experiment to be very suitable for the soil and climate. Beans, having been repeatedly found uncertain, are discarded for the present; oats answer well, about 50 acres are generally grown, and their area will probably be increased. No barley was sown last year, but now that it is relatively dearer than wheat, and producible with a saving of probably 10*s.* per acre on the manure bills, preparation is made for drilling 100 acres this year. The crops nearly ready to cut looked remarkably well, were reported to be more uniform than those of 1873, and annual visitors attracted in ever-increasing numbers declared that they improve yearly. With the exception of portions of one field behind the house infested with wild oats, and one small enclosure of five acres, the farm was beautifully clean. The best crops of 1874 were those on the thinner, lighter soils and following clover.

A brief description of the 20 rectangular fields into which the farm is divided, their former management, and present appearance, will prove instructive.

North from the house and premises is Well Field, a 50-acre enclosure of strong clay land, bearing in 1874 Rivett wheat after clover. A bushel and a-half of seed was drilled in October. The crop was horse and hand hoed and had no manure, save about seven acres, which looked badly in spring, and received $1\frac{1}{2}$ cwt. of nitrate of soda. In 1872 the field was wheat, in 1871 beans, and in 1870 wheat. The crop of 1874 was level, with a good bold head, promised to yield 7 quarters per acre, and on the 28th July made an average of 15*l.*

Cross Field, comprising 55 acres, grew sainfoin for three years, from 1869–1871, and has since borne three wheat crops. Last autumn it carried 33 acres Rivett wheat, which sold for 10*l.* 10*s.*; and 22 acres Browick red, more regular, kindly, and yielding, and sold cheap at 10*l.* 10*s.*

Dudley, measuring 40 acres, had ten years ago a dressing of London manure; in 1872, it was clover following wheat; about eleven acres were broken up and subsoiled 16 inches deep; more crude clay than was desirable was then brought to the surface; and Mr. Prout considers that the field has accordingly since required rather more manure. Wheat followed in 1873, and last year there were 30 acres of red wheat and 10 of Rivett, together averaging upwards of 10*l.* per acre.

Behind the Farmhouse is the Home Field, comprising 45 acres; 23 of which were originally in old grass of low quality, ploughed up by Mr. Prout, and, in spite of severe cropping, not yet exhausted of its riches. It was fallowed in 1862, but, with the exception of small patches under beans and other cleaning crops, it has grown cereals ever since; and, amongst the rest, five consecutive and remunerative crops of barley. Last season it was in Rivett wheat, drilled rather late, sold at an average of 9*l.* 16*s.*; not so regular as some other pieces, portions considerably "knee-broken," and here and there interspersed with wild oats, which will, however, be eradicated by the autumn and spring cultivation, preparatory for a crop of black Tartarian oats. Nothing at Sawbridgeworth, Mr. Prout assures me, has paid so well as the arable culture of the Home Field and other portions of inferior grass land. Continuous corn-crops have been produced at little expense; for several years scarcely any artificial manures were applied; the food for the million, as well as the profit for the farmer, must have been three times that which under any management could have been extracted from the original sour rough pasturage.

By the side of the turnpike road, approaching the farm-buildings, is Whitemoor, bearing 64 acres of black Tartarian oats, a fine level crop, put in early in March with the general-purpose drill. Three and a half bushels of seed were sown, with $1\frac{1}{2}$ cwt. Ohlendorff's prepared guano; a fortnight later $1\frac{1}{2}$ cwt. nitrate of soda was applied as a top-dressing, and the crops sold at an average of 9*l.* 15*s.* Although three cereals have been grown consecutively on part of this field, and five cereals over the remainder, the cultivation has been so thorough, and the crops have so rapidly and entirely covered the ground, that there has been little opportunity for weeds to flourish; and with the exception of a few patches of squitch-grass in some of the damp furrows, Whitemoor may be pronounced perfectly clean.

Blackacre, measuring 36 acres, was fallow in 1863, wheat in 1864, beans in 1865, and under white crops ever since. It was subsoiled 15 inches deep in 1872, has received subsequently artificial manures to the annual value of over 60*s.* per acre. It was perfectly clean, and the good crop of red wheat of 1874 realised all over 9*l.* per acre.

Brook Field, 31 acres, exhibited amongst the plastic clay a somewhat less proportion of calcareous matter, was clean and in good condition, and contained 15 acres of wheat, sold at 9*l.* 9*s.*, and 16 acres of red clover.

Beadles, mapped at 51 acres, presented its fourth white crop in direct succession; like the remainder of the farm it was perfectly free from weeds of all descriptions; the wheat sold at about 10*l.* per acre, and amongst it clover-seeds are sown out.

Cowcroft, one of the original small enclosures, measures 5 acres; some years ago it had hundreds of loads of tank-water applied without obvious effect: like other pieces it has been kept constantly producing corn-crops; has had no fallow since 1862; and being now rather foul is drilled with winter vetches, which some of Mr. Prout's west-country friends assure him will, without much trouble of cultivation, effectually choke and destroy all rubbish.

Mr. Prout had, in 1874, 45 acres of clover, which, averaging 10*l.* 8*s.*, paid as well as the cereals, and proved besides a good preparation for the succeeding wheat-crop. Although 27 acres were on land (Parkspring) which for five years immediately preceding had grown wheat, there was no difficulty in rearing a good plant. The success of the clover-crops depends upon the thorough autumn culture, and the use of the very best seed, of which 12 lbs. are deposited amongst wheat or with barley, usually by Holmes and Son's seed-drill, with 26 coulters. To ensure a full cut of clover, top-dressings are used. Last spring $1\frac{1}{2}$ cwt. of Ohlendorff's guano was broadcasted in March; the clover was mowed and carried in June; and the result, in two ricks, containing 70 tons of prime hay, was offered at the sale for 320*l.* Grass being scarce, it was determined to force the second crop with $1\frac{1}{2}$ cwt. of nitrate of soda. Owing to the continued drought probably little benefit resulted from the dressing; but the crop, which was to be mowed without seeding, brought at the auction sale, on the 28th July, 3*l.* 5*s.* 9*d.* Any unconsumed artificial manure will doubtless tell favourably on the wheat, for on his heavy land Mr. Prout is convinced that even the comparatively soluble nitrate of soda frequently fertilises more crops than one. So soon as the second clover is cleared off, usually towards the middle of September, the land is lightly ploughed.

East of the house and buildings lies a block of about 25 acres

not farmed on Mr. Prout's ordinary system. Part of the produce is retained and returned to the land; manure from the cart and carriage-horse stable is applied, green crops are grown, and it has been in contemplation to lay down a portion in permanent grass when it has been raised to a state of high condition. That it has already reached this desirable state is tolerably evident from the admirable results it yielded last harvest. Four acres carried a magnificent crop of Rivett wheat, which Mr. Prout, anxious to test the yield, bought in for 17*l.* 16*s.* It must reach 8 quarters. A bushel over that was Mr. Prout's highest return obtained in 1868. Four acres were devoted to black Tartarian oats, following rye-grass, and produced a yield of 10 or 11 quarters per acre. Conterminous were some fine cow-cabbage, suffering apparently little from the protracted summer drought, and a couple of acres of yellow globe mangold dunged, drilled with dissolved bones, thirty inches apart in the rows, a splendid regular plant, from which many of the lower leaves have been, with impunity, gathered as a *bonne bouche* for the Guernsey cows that supply milk for the family and servants. For this crop Mr. Prout had, on his sale day, an offer of 20*l.* per acre. A late planted but promising piece of swedes followed a crop of tares, which had been consumed by the cart-horses and dairy cows.

The remainder of the 25-acre home piece was occupied with 14 acres Italian rye-grass, broadcasted in August, 1873, on freshly scarified wheat-stubble, thrice cut, rapid growth being secured by a dressing of $1\frac{1}{2}$ cwt. nitrate of soda applied immediately the first cutting was removed. In a former season the rye-grass was sold for 20*l.* per acre, with the privilege of cutting and carrying off whatever grew from Lady-day to Michaelmas.

The busy season at Sawbridgeworth commences whenever the stubbles are cleared; steam and horses are fully occupied; thorough cleaning, horse and hand hoeing have, however, so thoroughly extirpated weeds that autumn scarifying is now seldom requisite. A furrow of 6 or 7 in. is turned over; 8 acres of such work is daily performed by the 14-horse engine and 4-furrow plough. An extra horse or two are occasionally purchased to hasten the ploughing and wheat-drilling, for the earlier and drier this calcareous clay is ploughed up and planted the better. For wheat only one furrow is given. But this autumn 100 acres, steam-ploughed in September, were six weeks later worked over with the 4-furrow plough, on which the coulters remain as usual, but from which the second and fourth mould-boards are removed. The ground, thus thoroughly cut and turned over, is left in a ridge-and-furrow form with a large surface exposed to the beneficial action of the weather, and when harrowed down in spring will produce an admirable seed-bed for the Hallet's pedigree

barley, for which it is intended. In early spring the wheat is sometimes harrowed, and invariably, as soon as practicable, it is horse and hand hoed, every advantage being taken of fine weather, and all available hands being set to work. The spring corn, forced with superphosphate or guano drilled with it, and shortly top-dressed with nitrate, speedily, covers the ground, and hence seldom requires hoeing.

The labour question has troubled Mr. Prout less than many of his neighbours. His steam-tackle economises both horse and hand labour, and keeps his labour account under 30*s.* per acre. His engine-men have from 18*s.* to 21*s.* a week; carters 16*s.*; ordinary labourers 15*s.*; some of the regular hands have also their cottage and garden rent free, and cows have been kept to supply each family with 3 pints of new milk daily—a boon which, however, has hardly been sufficiently appreciated; and the men, recently offered their choice of going on with their 3 pints of milk or accepting as an equivalent 2*s.* a week, grasped at the money, to the almost certain detriment of the health of their young growing children, who can get no other food so good and nutritive as milk. Like other employers, Mr. Prout complains that, pay as he may, he does not now get as much work done as formerly: young active men are said to be scarce, and he threatens to import a few picked hands from the North, whence, twelve years ago, he had the active intelligent bailiff, who has been of great service in successfully carrying out the details of his system. In the subjoined amounts paid for labour from 1868–74 the bailiff's wages of 100*l.* a year are included. Unlike most other farms, the labour payments have not increased during recent years; they exhibit an annual average of 635*l.* 14*s.* 4*d.*

	£	*s.*	*d.*
1868	609	14	6
1869	651	14	6
1870	634	5	6
1871	578	8	6
1872	756	8	10
1873	653	9	6
1874	567	14	6

The economical use of artificial manures is a matter of grave consideration with Mr. Prout, as with others who pursue high farming. Chief amongst the debateable points are what amounts yield the best returns? What are the suitable combinations of phosphatic and ammoniacal fertilisers? What mode of application is least wasteful? In the soil newly worked up by steam, and on the poor grass-land recently converted into arable, Mr. Prout's thorough cultivation secured full grain-crops with little outlay for artificial manures. For several years his

total annual outlay for manures did not exceed 500*l.*, being at the rate of about 20*s.* per acre. But as cereals continued to follow each other more plant-food had to be provided, and Mr. Prout now considers that he requires to expend upwards of 1200*l.* annually on portable manures, or between 50*s.* and 60*s.* per acre. During the last seven years the annual expenditure has not materially varied; the annual average is 1269*l.* 15*s.* 4*d.*, or about 55*s.* per acre. Whilst Mr. Prout anxiously studies economy in the use of these expensive fertilisers, he declares that it is often the last 10*s.* worth that brings the best return!

Bones, mineral superphosphate, guano, and nitrate of soda are the manures generally used.

A favourite mixture for drilling with the several crops is made with equal proportions of $\frac{1}{4}$-inch bones, freely saturated with water, and mixed with mineral superphosphate on the floor of one of the disused barns. The excess of acid in freshly prepared superphosphate, and the fermentation produced by the heat and moisture, dissolve the bones, and in about three months there remains a soluble richly phosphatic manure, which, after spreading out thinly, dries and, mixed with a few sifted ashes, is readily distributed either by hand or drill. Three to five hundred-weight of this mixture constitutes the usual dose applied to most of the cereals, excepting the wheat-crop on the clover leys, which derives pabulum sufficient from the unexhausted dressings applied to the clover, and from its gradually disintegrating roots.

Both Messrs. Prout and Middleditch prefer to apply phosphates as well as guano by drill. Thus, deposited in close vicinity to the rootlets, more immediate effects are produced, and less waste occurs from valuable soluble matters being washed into the subsoil.

What Mr. Prout chiefly requires in a drill is that seed and manure should be deposited from separate tubes, and the manure placed fully $\frac{1}{2}$-in. below the seed, from which it is thus separated by a thin layer of soil. The concentrated active manure is in this manner prevented from doing harm during germination when it is not wanted; but is sufficiently handy, and probably more fittingly diluted, when the tender spongioles, having exhausted their infant stores, are ready to decompose and absorb the food-supplies in the soil.

Priest and Woolnough's drills are used at Sawbridgeworth, and Mr. Middleditch has been in frequent communication with Messrs. John Fowler and Co. regarding the perfecting of a steam corn and manure drill which they hope to bring out. Mr. Prout has found considerable difficulty in getting the makers of drills to carry his ideas into practice: he complains that some of them have become very independent—they hold themselves aloof

from the Royal Agricultural Society's trials, and the Society and the public thus lose the benefit of their experience. The most effectual plan to bring all makers to the competitive trials would be to prevent manufacturers or their agents exhibiting any of the implements, which are specified in the prize sheet of the year, unless duplicates are also entered for trial competition.

The nitrate of soda, in doses varying from 1 to 1½ cwt., is generally broadcasted on the cereals in March or early in April, and on the clovers and rye-grass in early spring or after the first cutting is removed. Where more than 1 cwt. is to be used, a double chance of benefit results from applying the amount in two doses, at intervals of a week or ten days. Grateful and generous as is the well-managed soil, it is not necessary to entrust it with more soluble fertilising materials than are sufficient for the immediate wants of the growing crop.

No farming is fairly entitled to commendation unless it is also profitable, and the important practical question is, how does Mr. Prout's system pay? From the books and accounts, which are kept with as much care and order as the farm itself, a satisfactory balance-sheet can be produced. Few large concerns have such simple receipts; nearly the whole are realised from the auction sales, which were begun in 1866, were not held in 1867, but have since been continued annually. Having abstracted and averaged most of the payments for seven years, the same period may fittingly be taken for the receipts, and the totals of the sales since 1868 are accordingly subjoined.

	£	*s.*	*d.*
1868	4,726	0	8
1869	3,742	0	0
1870	5,232	7	4
1871	4,625	14	11
1872	4,743	11	10
1873	4,570	4	10
1874	4,628	2	6
	£32,268	2	1

This gives an annual average of 4609*l.* 11*s.* 5*d.* To this there remains to be added the produce of from 15 to 18 acres, part of the 25 acres lying near home, described on page 47, which, unlike the remainder of the farm, is not cropped so continuously with corn, nor fed so exclusively with artificials; it is usually devoted to growing hay and roots for the horses and milk-cows; but its labour and seed bills are included in the general payments, and its annual returns are estimated at 200*l.* This brings the total receipts of Blount's Farm to 4809*l.* 11*s.* 5*d.*

The annual acreable averages will convey to many a more definite idea fo the actual returns. The four years, 1868–1871,

inclusive, exhibit better results for wheat than the three later years, but this is not peculiar to Mr. Prout's farm. The dry, warm year of 1868 produced, especially on heavy land, one of the most prolific wheat-crops ever grown in England. The early season of 1870 was also favourable for clay-land crops.

The following Table presents the acreable returns obtained from each of the seven sales :—

1st. For the whole of the crops sold.

2nd. For the wheat-crops alone.

3rd. The average value of wheat per quarter for the week in July in which the sale was held.

Years.	Total Averages.	Wheat Averages.	Price of Wheat on Week of Sale.
	£ s. d.	£ s. d.	£ s. d.
1868	12 0 2	14 14 2	3 2 9
1869	10 12 6	14 6 8	2 11 9
1870	12 6 6	15 3 10	2 12 10
1871	10 19 3	14 3 2	2 18 0
1872	10 16 0	11 0 5	2 19 1
1873	10 0 0	10 8 11	3 0 0
1874	10 13 3	10 17 7	2 18 0

The annual payments for labour, manure, and auction sale, have already been noted and commented on. Considering the quality of the land as well as the capital sunk in its purchase and improvement, 900*l.* a year, or 40*s.* per acre, may be taken as a reasonable rent; rates and taxes absorb about 220*l.*; the keep of the 6 agricultural horses and the 2 nags is set down at 30*l.* each. As the fodder and roots consumed by the 2 dairy cows have been credited amongst the receipts, 40*l.* a-year must be added for the keep of the cows. These items, with 250*l.* for seed, and 230*l.* for expenses of steam-culture, are detailed in the subjoined statement.

	£
Manual labour, including bailiff's salary of 100*l.*	635
12 months' keep of 6 agricultural horses, at 30*l.*	180
,, Carriage-horse and pony	60
,, 2 milk-cows	40
Engine and tackle cost 1065*l.*, interest at 5 per cent. ..	53
,, Depreciation annually at 5 per cent. ..	53
,, Wear and tear of machinery	77
,, Coal bills	42
,, Oil	5
Corn and clover-seeds	250
Artificial manures, at 55*s.* per acre	1269
Auction sale expenses	200
Rent, 2*l.* per acre	900
Rates, taxes, and tithe	220
Total annual payments	£3984

Abstracting the seven years' accounts from 1868 to 1874, inclusive, the results stand thus:

	£	s.	d.
Receipts	4809	11	5
Payments	3984	0	0
Profit	£825	11	5

An annual profit of 825*l.* derived from 450 acres of rather second-rate clay-land, and maintained throughout seven years, affords satisfactory testimony to Mr. Prout's system. That the consecutive corn-crops sold off year by year have not exhausted or deteriorated the land is evident from the improved quantity and quality of the growing crops, and very notably also from the increased value of the farm, which, instead of the 33*l.* originally paid for it, would now bring double that amount. Indeed, so recently as February, 1875, the estate, purchased at less than 16,000*l.*, has been valued by a very competent surveyor at 31,000*l.* This enhanced value represents a handsome return, not only for permanent improvements, but also for the meagre profits of the earlier years of Mr. Prout's occupation. Very few land investments, under any description of management, pay, like Mr. Prout's, a fair interest on outlay and double their value in thirteen years.

Mr. Middleditch, settling himself down to farming in 1866, after several years' commercial pursuits in India, was struck with the accounts of Mr. Prout's agricultural successes: a survey of the clean and bountiful crops at Sawbridgeworth made him an enthusiastic disciple; and he determined to prosecute the system at Blunsdon, three miles from Swindon, where he had just acquired 160 acres of heavy clay-loam. But this small holding affording inadequate scope, he purchased four other conterminous farms, making, with 44 acres of land rented, an aggregate of about 600 acres arable and 100 acres pasture. He rehabilitated an old farmhouse, surrounded it with a pleasant shrubbery and garden, planted a belt of plantation as shelter from the south-west winds, which drive up rather severely some 35 miles from the Bristol Channel. From his elevated healthy site on the coral-rag ridge, he overlooks his compact farm, commands a magnificent view of the beautiful valley of the White Horse, counts upwards of a dozen village churches, and in bright weather catches the light reflected from Cirencester College, eleven miles northwards. To the east of the house lies the pleasant village of Blunsdon, quaintly-built on sloping limestone banks, with springs of splendid water trickling forth from almost every garden.

But seven years' anxious thought, hard labour, and liberal well-directed outlay of capital, have been required to make Blunsdon what it now is. To the purchase-money, which averaged 70*l.* per acre, fully 20*l.* have been added in draining and other improvements. Eleven miles of wide, worthless, wasteful hedgerows have been grubbed up; 180 acres of poor sour wet grass have been converted into profitable corn-land; instead of small enclosures, there are now a field of 240 acres, another of 150 acres, two of 50 acres, the others somewhat smaller. Nowhere have I seen draining more carefully and thoroughly done; nowhere does steam exhibit greater triumphs of deep, thorough, clean culture. The land is mostly a strong clay-loam, tolerably friable from admixture of vegetable fibre, the result of its having only recently been brought under arable culture. It is of deeper and better quality than Mr. Prout's. Underneath the loam is a thin stratum of yellow marl mixed with clay, resting about two and a half feet down on beds of marl and blue clay, which extend downwards for many feet. The superior quality of the soil doubtless mainly depends upon its being at the meeting of the three geological strata, the coral-rag, Oxford clay, and the alluvial deposit which constitutes a portion of the old basin of the Thames. Forty acres having been little more than three years in Mr. Middleditch's possession, are still, as he describes them, in a transition state, and have not yet been entirely freed of their former heritage of couch, docks, and garlic.

During three years Mr. Middleditch effectually drained his 700 acres, at a cost varying from 8*l.* to 15*l.* One field of 8 acres, drained with 4-inch pipes, actually cost 19*l.* 3*s.* 6*d.* per acre. A portion of the money required has been borrowed from the Lands Improvement Company, at an annual charge of 6*l.* 14*s.* 1*d.* per cent., which in 25 years pays both principal and interest. Often he has had 100 men busily at work, in gangs of three or four, making the four-foot excavations at a cost of from 2*s.* 6*d.* to 7*s.* 6*d.* per chain; a trustworthy man on day-wages is told off to lay the pipes for about 20 excavators; to ensure the levels being kept, and the fall, which is sometimes not very great, being made the best of, water was systematically let down every drain before the pipes were laid. The draining of heavy land being uncertain, and often ineffectual, when the pipes run askew or across high-backed lands, the drains at Blunsdon have invariably been placed in the original furrows, which vary from 5 to 7 yards. Little reliance is placed on 1-inch, or even 2-inch pipes, which Mr. Middleditch considers liable to get displaced or blocked, and he has accordingly buried but few smaller than 3-inch pipes, whilst in the lower portions of the

longer furrows, and wherever the fall is inconsiderable, 4-inch pipes are used.

The mains have 6, 9, 12, and even 15-inch pipes. A proportion of these larger pipes for the mains are made with 4-inch inlets, into which the furrow-pipes are securely fixed. Approaching the outfall a few glazed socket-pipes are used, to diminish risk of injury from frost; and every outlet is neatly and securely built up, and the opening protected with a stout iron grating. In striking contrast to the 12-inch outfall pipes five feet down, Mr. Middleditch has also built in one of the 2-inch pipes, which his predecessors used for their main exits, and buried only two feet from the surface. Several of the mains empty into convenient pools, supplying water used chiefly for the steam-tackle. This draining is certainly costly, but it is unusually effective. During the first week of 1875 it was subjected to a severe test. The heavy snow which had come down during the previous ten days, and represented probably two inches of water, suddenly melted, with the additional fall of about an inch of rain; the 12-inch mains ran three-quarters full; four days later, on January 8th, I walked over Mr. Middleditch's fields and was surprised to find the land dry and firm, no evidence of flood or washing remained; the surface of the heavy land was not caked or run together, not a blade of wheat or a bean-plant was injured. Over the hedge, in fields drained at shallower depths with smaller pipes, the mains being of insufficient capacity, and the ground puddled with horses' feet, walking was heavy, water was not fully removed from the furrows, and the surface was run together in a manner likely to interfere with the future growth of the wheat.

Mr. Middleditch began farming with horses, but finding that his work was not sufficiently rapidly and seasonably performed, he shortly hired steam; and in 1871 he purchased two of Messrs. John Fowler and Co.'s 20-horse engines, with ploughs, scarifiers, &c. Strictly and intelligently looked after by the master and his staff, this powerful set has done an immense amount of capital work. Of superior manufacture, and largely made of steel, they can safely work up to 100 horse-power. Mr. Middleditch furnishes me with the subjoined statement (p. 55), setting forth the work performed for himself and his neighbours for the past four years. In 1873 and 1874 about 200 acres have besides been drilled by steam.

Mr. Middleditch's thoroughly and deeply cultivated clean fallows amply testify to the efficiency of his steam-tackle. It is impossible to have work better done; the 90 acres fallowed in 1874 have mostly been cultivated five or six times to a depth of 12 or 15 inches, and 20 acres of one heavy clay piece, on the

occasion of my visit in July, was receiving an efficient subsoiling to a depth of 28 inches, at a cost of about 20*s.* per acre. This operation is undertaken chiefly for the purpose of ensuring superfluous rainfall finding its way through the adhesive clay to the drains. But where the land is not puddled or trodden with horses' feet in wet weather, such subsoiling will not be required to be repeated for 8 or 10 years. The daily consumption of coal when ploughing 10 inches deep is about 2 tons; coal costs 20*s.* a ton at Swindon. At convenient points pools are formed from which water is obtainable even in the driest seasons. Throughout the farm good roads have been made, along which engines and water-carts conveniently travel. Archways over ditches have been strengthened and widened; the field gateways are set out to 20 feet, and provided with double gates. The multifarious steam-machinery is carefully housed in the disused barns and shedding; whilst engineers and other regular servants are comfortably located in the commodious dwellings which erewhile were the farmhouses of the several holdings now gathered into one.

		Subsoiling.	Ploughing.	Cultivating.	Dragging.	Total Work.	Amount earned.
		Acres.	Acres.	Acres.	Acres.	Acres.	£ s. d.
1871	Mr. Middleditch ..	48	257	508	1421	2234	
	For hire	..	54	135	..	189	102 12 0
1872	Mr. Middleditch ..	35	495	292	1692	2514	
	For hire	..	124	168	260	552	306 12 1
1873	Mr. Middleditch ..	..	399	367	854	1620	
	For hire	..	78	917	708	1703	747 4 6
1874	Mr. Middleditch ..	72	364	421	1156	2013	
	For hire	..	31	548	294	873	310 4 0
		155	1802	3356	6385	11698	1466 12 7

The economy of steam as compared with horse-power in cultivation especially of the heavier soils, cannot now be questioned. Indeed, estimating the enhanced value of horses, the increased cost of horses' food, with the damage that horses do by treading and poaching, and the comparative tardiness with which they perform autumn work, it appears difficult to understand how heavy arable land can be profitably managed by horse-power. The advantage of steam is forcibly exhibited in the following statement prepared by Mr. Middleditch, the estimate

of cost being taken for the more common 12 or 14-horse-power tackle.

APPROXIMATE COST OF STEAM CULTIVATION WITH FOWLER'S 12 OR 14-H.P. TACKLE.

	£	s.	d.	£	s.	d.
Interest on 2000*l.* at 5 per cent. for 1 year, 100*l.*, or working 200 days per annum, per diem				0	10	0
Depreciation on 2000*l.* at 15 per cent. for 1 year, 300*l.*, or working 200 days per annum, per diem				1	10	0
Wear and tear, duplicates and repairs, 100*l.* per annum, per diem				0	10	0
Ropes, 100*l.* every 2 years, or per diem				0	5	0
Oil, 25*l.* per annum, or per diem				0	2	6
Coal, two tons per diem at 25*s.* per ton, average				2	10	0
Manual labour—Head driver per diem	0	3	4			
Second do. do.	0	2	6			
Ploughman do.	0	2	2			
Boy do.	0	1	8			
				0	9	8
Water and coal carting, per diem				0	10	0
				£6	7	2

Plus piece-work wages as under:—

Cost of ploughing—			
12 acres per diem—cost as above—per acre ..	0	10	7
Extra for piece-work—per acre	0	0	9
Total per acre	0	11	4
Cost of cultivating—			
20 acres per diem—cost as above—per acre ..	0	6	4
Extra for piece-work	0	0	6
Total per acre	0	6	10
Cost of dragging—			
70 acres per diem—cost as above—per acre ..	0	1	10
Extra for piece-work	0	0	3
Total per acre	£0	2	1

This is not much over half the cost at which similar work on heavy land is done by horses. But even these moderate rates may be further reduced where the tackle, when it can be spared, is hired out. In many localities 300*l.* to 400*l.* may thus be earned annually, reducing, probably to the extent of 20 per cent., the cost of the work done at home. It is those extra earnings particularized above which enable Mr. Middleditch to perform his steam-work at the very low rates of 8*s.* per acre for 6 to 8 inch ploughing, 6*s.* 10*d.* for cultivating, and 1*s.* 6*d.* for dragging. The principle of paying by results is introduced as far as possible,

even with the steam-work. The enginemen have a standing wage ranging from 13*s.* to 20*s.*, and receive besides a premium of 3*d.* per acre for dragging, 6*d.* for cultivating, 1*s.* for ploughing, 1*s.* 6*d.* for subsoiling. The principal carter has 3*s.*, the second 2*s.* 6*d.*, per day. These, with 2 boys, constitute the entire ordinary working-staff of the farm of 700 acres. This economy alike of horse and hand-labour is a very striking feature of the farming at Blunsdon. Mr. Middleditch's predecessors on the farms he occupies used 36 horses; he generally has 5 or 6. The cost of manual labour for the arable land throughout the district is upwards of 30*s.* per acre; including enginemen, carters, and extra hands hoeing, his is under 20*s.*

Steam has greatly contributed to Mr. Middleditch's successes: it has enabled him to have his work done thoroughly and economically, his land ploughed up early, and, whilst it was dry, his seed put in well and seasonably. In 1874 he began drilling with five pecks of wheat on 20th September, increased his seeding to about six pecks throughout October, and had finished 450 acres of planting by the first week in November! To make the best use of those few precious weeks which immediately follow harvest, he has recently purchased a second set of steam-tackle, consisting of a pair of Messrs. Fowler and Co.'s 14-horse-power engines, with ploughs, cultivator, &c. This will render him independent of the six or eight horses which he has been in the habit annually of purchasing or hiring in autumn, and using for getting his seed in. Although one purchased horse went quite wrong this autumn, the loss on the seven bought—and sold after ten weeks' hard work—was only 31*l.* The perfecting of the steam-drill, which is now heavy, difficult to steer, and only 7½ feet wide, will considerably expedite and economise autumn labour. Mr. Middleditch believes that a steam-drill will shortly be produced, probably in two sections, each 10 feet wide, capable of sowing 40 acres a day, putting in both seed and manure, and with drags attached before and behind.

During the earlier years of his occupation Mr. Middleditch was so confident of the power of steam to cleanse foul land, and so anxious to secure full annual returns, that he regularly cropped the whole of his arable area, and trusted to autumn culture to get rid of the rubbish he had inherited. In 1873 almost the whole farm was devoted to corn; but wet seasons favoured weeds; and in 1874, 90 acres were in bare fallow; in 1875, 43 acres will be under mangold or potatoes, about 20 acres in summer-fallow after vetches. As at Sawbridgeworth, wheat has hitherto been the staple produce, five crops have sometimes followed in direct succession. The strong deep land is pro-

bably more suitable for wheat than for barley or oats. Beans are found remunerative, and a good preparation for wheat. Clover has not yet been systematically grown. A week or ten days before harvest the growing crops are sold by auction. Both straw and grain are removed, but Mr. Middleditch evidently parts regretfully with his superior crops, rightly thinking that he could harvest them as well as anybody else, and might enjoy the purchaser's as well as the grower's profits.

Leaving the house and passing westward through the garden and orchard, and still on the thin coral-rag, are two acres of lucerne, kept clean by frequent horse and hand hoeing, cut three or four times a year, chiefly for the horses, and proving so serviceable that its culture will speedily be extended. Adjacent, and still on the upland limestone-rag, are 35 acres of sainfoin, laid down in 1871, and bringing annually between 6*l.* and 7*l.* per acre: in 1874 it realised 8*l.* 5*s.* The first crop generally fetches 5*l.*; occasionally it has been cut twice: the aftermath, which is fed off, usually brings 30*s.*; but, owing to the scarcity of grass, when put up for public competition on July 23rd, 1874, the grazing, let until October 1st, averaged 3*l.*, whilst one lot realised 90*s.* At this high figure it was rented to afford a fresh and healthy bite for 150 superior Cotswold lambs. To no better purpose than the growing of sainfoin can this thin limestone soil be put. To sustain fertility the crop receives an occasional dressing of the limited amount of stable-manure which is made, and is also helped by the cake and corn given to the sheep which graze down the autumn bite. When the sainfoin has exhausted itself, one or two capital corn-crops will follow; but there is neither depth nor staple of soil to justify the adoption of the consecutive grain-crops, which can be produced on the lower, deeper, and heavier portions of the farm.

From the table-land on which stand the house, garden, and sainfoin field, a few steps bring us to the gently-sloping enclosure of 150 acres of especial interest in the annals of steam-ploughing—where fourteen years ago one of John Fowler's engines astonished the Wiltshire farmers by its power and aptitude for land-culture. In 1874 this large field was chiefly seeded with Rivett wheat, the third wheat-crop in succession—fully 100 acres, of splendid promise, standing on the sale-day beautifully erect; some of the straw upwards of 6 feet high; many heads discoverable numbering 100 grains, and one giving the bountiful increase of 120 grains. The best portion sold for 17*l.* 5*s.* per acre, and, even with the autumn fall in the value of wheat, must still have left a fair profit. Several plots when threshed out averaged 7 quarters; one reached $8\frac{1}{4}$ quarters. The stout bright straw, which looks like 40 to 45 cwt.

per acre, will probably, as in former years, be disposed of for paper-making, the Spanish wars having interfered with the supplies of the Esparto grass. For cutting, tying, and shocking, 25*s.* per acre is being paid. Some of the best of this good crop is on land which Mr. Middleditch found under old turf, but on which corn has since been grown uninterruptedly for three, and on one portion for four years. On one part of this enclosure where it was recently drained, with the further disadvantage of being ploughed and drilled wet, the crop was thin and poor, several lots realising only 4*l.* per acre. Amongst these thin portions wild oats had shown themselves, and Mr. Middleditch is now convinced that a summer-fallow or early-spring cultivation, and a crop of oats or barley, would have answered better than wheat. For two years, excepting for drilling and hoeing, horses have not been employed in the cultivation of this large field. During September, 1873, the steam-ploughing was performed in ten days, the engines working from daylight till dark. In October, 140 acres were drilled with about 1½ bushel of Rivett wheat, in 10-inch rows: a considerable proportion was deposited by the steam-drill. In spring the crop was harrowed, part of it horse-hoed, most of it hand-hoed, whilst the weakest portions of it received a dressing of about 2 cwt. superphosphate, and 1 cwt. nitrate of soda.

Visiting Blunsdon on January 8th, 1875, I found that 70 acres of this fine field had been steam-ploughed in September, dragged and again drilled with 6 pecks of Rivett wheat, which looked forward and vigorous, and perfectly clean; indeed with such crops there is little room for weeds. Sixty acres, including that portion where the inferior spring-wheat had grown, have been steam-ploughed early, advantage taken of the dry weather in August, dragged and drilled October 12th to 16th with winter beans. Two bushels of seed were deposited per acre, in rows 19 inches apart, with the steam-drill, which delivered at the same time doses of the following manures:—3 cwt. superphosphate; 2 cwt. superphosphate with 4 cwt. ashes; 5 cwt. lime with 1 cwt. salt; 6 cwt. Bristol manure, made from the dead and damaged Irish, foreign, and colonial beasts, from which all available fatty matter is first extracted. To secure the regular distribution of these manures, they are drilled along with 1 cwt. of kiln-dust, obtained from Burton at a cost of 4*l.* per ton. Five acres are set apart for each manure; up the middle of each plot is a strip from which the manure has been altogether withheld. Such experiments may probably discover what hitherto has been a desideratum, namely, a trustworthy portable fertiliser for the bean-crop. Throughout the beans look remarkably strong and regular, and promise to be

as easily cleaned, and more prolific, than those grown in 1874 on the plan of two rows 8 inches apart, and on each side a fallow strip of 26 inches. But even with these wide spaces, the 18 acres of 1874 averaged 9*l.* 10*s.* Twenty acres of this 150-acre inclosure steam-ploughed, dragged, and dunged on the surface, now lie ready for mangolds or potatoes, for which Mr. Middleditch expects to obtain as ready and remunerative a sale as for his corn-crops.

The North-field, a farm in itself, comprises 240 acres. Over 220 acres of this broad level expanse, unmarked by lands or ridges, with only a few furrows cleared out in some of the old boggy places, waved in July, 1874, a splendid regular crop of Biddell's Imperial wheat. Cereals have been grown in various portions for four or five years without intermission, the latter crops proving quite as good as the first. After steam-ploughing and dragging, 6 pecks of seed were put in, during the first week in October, partly by horses and partly by steam-drill. The steam-drilled land was hand-hoed, as the seed was not sufficiently regularly deposited to permit the use of the horse-hoes, which went twice through most of the horse-drilled wheat. On all, except the newly broken-up land, 3 cwt. of dissolved bones were applied at seed time; 1½ cwt. nitrate of soda, as a top-dressing, in spring. For this fine field the average acreable price obtained, in July, 1874, was 11*l.* Twenty acres on the upper side of this large enclosure were, during 1874, thoroughly summer-fallowed. One of the last remaining of the superfluous hedgerows, with many tons of tree-roots, has been effectually torn out, and the ground levelled and made ready for profitable occupation. As soon as the crop of 1874 was cleared off, the steam-plough was at work; about 40 acres were scarified, but this leaves too much stubble and rubbish on the surface, and in the succeeding summer is more apt to be overrun with weeds. Rivett and blue-cone wheat, to the extent of 6 pecks per acre, were drilled; the work being finished early in October. One portion of the field harrowed about a week after drilling has been left rather thin, but the whole of the wheat is most promising. On 20 acres of the heaviest portion of this field, never yet subjected to thorough cleaning, vetches are drilled, presenting a thick good crop, intended for sale, most probably to be penned off in May with sheep; for, partial as Mr. Middleditch is to portable fertilisers, he knows full well how much condition heavy land receives from liberally-fed sheep, penned on it during dry weather.

The three meads, comprising 33 acres, presented, in July, 1874, a good crop of Rivett wheat. Although the fourth corn-crop in direct succession, the thorough autumn culture, horse and hand-hoeing, and uniform regular crops, prevent the growth

of weeds. Three cwt. of dissolved bones and $\frac{3}{4}$ cwt. of nitrate of soda have been used this year as manure, and the field made an average of 13*l.*; in 1873 it reached nearly 15*l.* The prospects for 1875 are equally good; steam-ploughing and dragging were early finished—a matter of paramount importance in the profitable management of this heavy land: two bushels of Browick red, the fifth wheat-crop in succession, were steam-drilled in October, with about 3 cwt. of dissolved bones, and by the first week in January the plant looked very forward, many of the rootlets already down several inches, and tillering as much as many crops will have done in April. On Newlands were 34 acres of Rivett wheat, the fourth corn-crop in succession; not so strong or thick as some other pieces, but averaging 10*l.* per acre. During the summer of 1874, 12 acres adjoining were thoroughly fallowed. On these pieces, in October, 6 pecks of Browick red were drilled with the usual dose of phosphates, and three months later the wheat looked forward and promising, especially on the summer-fallowed portion.

Mr. Middleditch, although not very partial to grass-farming, still reserves about 100 acres of old turf, kept, he declares, more for amenity than profit, and because his friends tell him that, if his estate were for sale, purchasers would deplore the want of permanent grass, hedgerows, and trees. The grass, for years, has evidently been neglected and very wet. In the trial holes the water stood before the draining, even in a dry time, within a foot of the surface. The whole of the ploughed land having been dried, the grass was drained during the winter of 1873–74. Mr. Middleditch is not troubled with the fear, still somewhat common, that his grass-land may be overdrained. Down into 4-ft. drains only surplus water flows, and in a dry season the 4-ft. stratum must be saturated before water runs to waste. Drained so recently, the grass has not yet fully profited by the operation; the herbage is still rough and of improvable quality. But even in its present condition, it yields a fair return. Let by auction in May, for six months, it has averaged annually during the four yearly auction sales a little over 4*l.* per acre. But these are insignificant results compared with what the old turf does when ploughed up. Some sour grass, worth little more than 20*s.* per acre, ploughed up four years ago by Mr. Middleditch, has since produced, at an annual cost of about 5*l.* per acre, three consecutive wheat-crops making the following profitable acreable returns, and presenting besides an excellent prospect for 1875:—

	£	*s.*	*d.*
1872	13	10	0
1873	14	0	0
1874	17	0	0

Instead of following the present prevailing practice of laying down land to grass, irrespective indeed of its fitness, better results might often be secured by the more extensive use of thorough steam-cultivation, whilst the ploughing up and subsequent good management of inferior grass-land will frequently afford profits sufficient to buy the land in ten years.

Submitted to the critical test of figures, how has Mr. Middleditch's farming paid? Will the money, so liberally invested, bring a fair percentage? On the credit side of the account may be set down a return of 10*l.* per acre. Many years' experience, both at Blunsdon and at Sawbridgeworth, have shown that this average may be depended on. Four and a half quarters of wheat may be realised, and even at 45*s.* this nets 10*l.* 2*s.* 6*d.* Oats and barley have, of late years, maintained about the same acreable value.

Turning to the debtor side of the account. The land, with its draining and other improvements, has cost nearly 90*l.* an acre; to secure for this outlay an adequate return, 3*l.* is charged as rent; 2*s.* 6*d.* per acre goes for rates. Ploughing, harrowing, drilling, and hoeing absorb about 20*s.*; seed, 15*s.*; about 40*s.* will be required for manures, consisting of about 3 cwt. dissolved bones and 1 cwt. nitrate of soda; whilst 10*s.* must be set down for auction expenses. Mr. Middleditch furnishes me with the following details:—

	£	*s.*	*d.*
Rent and rates	3	2	6
Steam-ploughing	0	8	0
Steam-dragging	0	3	0
Drilling	0	2	6
Seed	0	15	0
Harrowing	0	1	6
Artificial manures	2	0	0
Horse- and hand-hoeing	0	4	0
Auctioneer's sale expenses	0	10	0
Total	£7	6	6

The figures above detailed indicate that Mr. Middleditch derives a profit of nearly 55*s.* per acre,—a tolerably satisfactory return for his expenditure, skill, and labour. It is very doubtful, however, whether similarly handsome profits could everywhere be depended on. Where steam has to be hired, or horses used, the expenses of cultivation would probably be trebled. Further, to secure thorough cleanness on most soils, an unremunerative bare fallow or expensive root-crop would occasionally be required, which, if recurring every seven years, would add another 20*s.* to the expenses, and swallow up profit. On the other hand, some items of the above expenditure might be reduced. Sixty shillings

per acre is a high rent even for the deep fertile land of Blunsdon, and for about 40*s*. land of fair quality, well drained, and in large rectangular enclosures, can be procured in many parts of England and secured, it is to be hoped, to an enterprising tenant, either with a twenty years' lease or an engagement to obtain remuneration for unexhausted improvements, or better still with both.

The system of farming described in this Report, if it is to be followed elsewhere with the successes which have been secured at Sawbridgeworth and Blunsdon, must be carried out amidst similar favourable conditions.

Steam-power is a *sine quâ non;* without it the occasional deep-stirring and thorough autumn cultivation, so essential for rapidly obtaining a suitable seed-bed and eradicating weeds, could scarcely be secured. The use of steam in its turn obviously requires large rectangular fields, deep drainage, absence of trees and landfast stones, and more capital than at present is possessed by most of the occupiers of small clay-land farms.

A deep and rather retentive soil is most favourable for the system. The thinner limestone formations and porous friable soils, unlike the clays, do not contain such a mine of varied plant-food which can, in great part, be rendered available by deep thorough cultivation. Nor do they retain, with comparatively little waste, the more soluble constituents of plants, whether elaborated in the soil or applied in the form of portable manures. The system, it is urged, is not self-supporting: from foreign sources fertilizers must continue to be obtained; guano deposits will be used up. But, practically, the supplies of phosphates and nitrates are almost inexhaustible.

A dry climate is also a necessary condition of successful continuous corn growing. Amidst the frequent mizzling showers of the extreme south-western counties of England or Ireland, or in many parts of Cumberland and Westmoreland, with their rainfall of 60 to 70 inches, it would be futile to extend corn growing, or reduce the area of the roots and grass which, in such moist districts, thrive and pay.

Still another condition would have to be secured, namely, the permission of the landlord to pursue a system of cropping, which has hitherto been almost universally proscribed, which is opposed to custom, inconsistent with the accepted principles of good farming, and supposed to exhaust and deteriorate the land. A longer continuance and wider multiplication of the experiences of Messrs. Prout and Middleditch will, doubtless, be required to remove many of the prevailing opinions relating to land-tenure: amongst other things, to establish the inutility of most of the restrictive cropping clauses which encumber our agreements, to

demonstrate that, in the long run, more cannot be extracted from the land than is put into it; and to secure to the skilful responsible tenant the liberty to plant what he pleases, unless during the two years previous to his leaving, provided always he keeps his land clean and grows good crops.

Some landlords and tenants may, perhaps, be sceptical as to the fertilising powers of thorough cultivation and portable manures—the two chief factors by which the fertility of these farms has been improved and maintained. But thorough cultivation ensures the free entrance of sunlight, air, and moisture into the soil, and thus ameliorates and renders more soluble and fit for plant-food the crude materials which abound especially in stubborn clays. Again, artificial manures must not be regarded, as they still often are, as "stimulants" to be used sparingly and occasionally, but eventually leading to serious exhaustion of the soil. Judiciously applied, they supply directly to the growing plant the materials with which its textures are built up, whilst they sometimes render available certain constituents of the soil which otherwise could not be taken up by plants. Farm crops are not capricious as to their food. They cheerfully elaborate their grains and roots from any convenient sources of plant-food. It is comparatively immaterial whether the elements of plant-nutrition be of home or foreign origin, whether they enter the soil in concentrated or bulky form, whether they come directly from the fold-yard or from antediluvian stores. The essential matter is that they be, in quantity and variety, sufficient for the demands of the plant, and presented in a moderately soluble state. The phosphatic and ammoniacal dressings regularly used at Blount's Farm and Blunsdon present about a fair equivalent for the phosphates and albuminoids annually removed in the crops. From the soil and atmosphere the other materials requisite are readily obtained.

Messrs. Lawes and Gilbert's invaluable experiments—one of the chief store-houses of the reliable facts of scientific agriculture—demonstrate that on heavy land the maximum returns both of wheat and barley have been reached with portable manures, and that on an average of twenty-five years dissolved bones and nitrate of soda, to the value of about 60*s.* per acre, produced several bushels more than an annual dressing of 14 tons of good farmyard-manure.*

But it has been urged that fertility resulting from the use of artificials must be ephemeral. The Commissioners of the Royal Agricultural Society, reporting on Steam Cultivation in 1866

* 'Journal of the Royal Agricultural Society,' vol. xxv., and vol. ix., 2nd Series.

('Journal,' Second Series, vol. iii.), after inspecting Mr. Prout's farm, declared that "the course here pursued is exceptional, and must soon come to an end; manure will soon be wanted." This foreboding has not been justified. The system has been strictly persisted in. Eight crops have since been reaped, showing no falling off either in quantity or quality, all of them much over the average of the district, yielding an acreable return of 10*l.*, exhibiting an annual acreable profit of 40*s.* Phosphates of lime and nitrate of soda—the staple manures used by Messrs. Prout and Middleditch—certainly do not furnish all the materials requisite for the nutrition of plants, and it has been declared that sooner or later other elements, at first present in the soil, will become exhausted. Granting that in some soils such exhaustion may occur, the failing potash, chlorine, silica, or other element might be cheaply supplied. Even under ordinary farm-management the replacing of articles of plant-food, which are actually wanting in a particular soil, is frequently a more convenient and economical method of maintaining fertility than the supplying, as in farmyard-manure, of a general assortment of all the elements of plant-food. The practical problem appears to be—With a given soil and surroundings, what are the cheapest raw materials from which to manufacture the particular crops desired?

Messrs. Lawes and Gilbert's experimental plots furnish the best practical refutation of the supposed fleeting and unstable effects of artificial manures. For upwards of twenty-five years phosphates and nitrate of soda, at a cost of about 60*s.* per acre, have maintained rather poor heavy clay-land in a maximum state of fertility, producing corn-crops continuously, and returning, on an average of twenty-eight years, nearly 36 bushels of wheat, and during twenty-three years nearly 50 bushels of barley. The averages for the last ten years being better than those previously obtained, justify the conclusion that there is no retrogression, and that the same management which has economically secured this high fertility can permanently maintain it.

The farms described admirably illustrate the power which the judicious outlay of capital exerts in developing the resources of the soil. Nor does a long period necessarily elapse before good returns are realised. Within a dozen years Blount's Farm has doubled its selling or letting value, whilst seven years' spirited management have already added fully 20 per cent. to the value of the Blunsdon farms. Former tenants, at much lower rents, regularly becoming impoverished, are superseded by men of skill and capital, who, although weighted with enhanced rents to meet the interest chargeable for costly improvements, manage to double the acreable produce and make the concern profitable. Similar results are obtainable elsewhere. What has been done may be

done again. Throughout our generally well-farmed island are still thousands of acres of unprofitable clay, poor thriftless grass-land, and worthless wastes, on which the system described in this Report might be successfully prosecuted. But capital is with difficulty attracted into such hitherto unprofitable channels. Landlords themselves seldom have the time, taste, or spare funds for such enterprises. Whilst, without more permanence of tenure than is generally accorded, or a more widely recognised payment for unexhausted improvements, tenants of skill and means obviously are indisposed laboriously and expensively to raise the land they hire from a state of unremunerative barrenness to one of high and remunerative fertility. Nor is this to be wondered at. Several years elapse before even essential and judiciously effected improvements fully repay their outlay. Throughout England long leases, as of 19 or 21 years, which afford definite permanence of occupation, and an opportunity for tenants to recoup themselves for substantial costly improvements, are uncommon. Cases occur in which the death of landlord or tenant, or the sale of property, produces, on short notice, a change of tenancy, and the reversion to the landlord of the occupier's capital. Such arrangements, too generally countenanced by custom, sanctioned by law, and peculiar only to agricultural occupations, obviously are a serious check to the expenditure of farmers' capital. The several classes concerned in agricultural prosperity, and whose weal or woe are so indissolubly connected, suffer together. The farmer's exertions are restrained; he has seldom liberty to make the best of his manufactory of bread-stuffs or meat; obsolete arrangements, devised to prevent deterioration of the occupation, unfortunately often prove more effectual in preventing its improvement; uncertain whether he may enjoy time or opportunity to realise a return for extra expenditure, he is chary of laying out his capital; his produce falls short of what it should be; his profits are small. The landlord, who under any system must eventually obtain, without cost, a considerable share of all permanent agricultural improvements, has the resources of his property only very slowly and imperfectly developed, whilst his rent-roll shows little prospect of improvement. The labourer, under such a system, seldom has constant or remunerative employment. The community at large pay higher prices for bread, meat, and dairy produce.

Both Messrs. Prout and Middleditch are strongly impressed with the need of improvement in the system of land tenure. They rightly declare that no tenants would have been justified, under any system at present in existence, in undertaking the costly improvements which they have made.

This Report has not been prepared with the idea that agricul-

turists everywhere will slavishly copy Messrs. Prout and Middleditch's system; that corn-growing is generally to supersede stock-farming; that auction sales of standing corn are to become as common as those of live-stock, or that corn-crops will generally be removed from the farm, and all land henceforward deprived of its accustomed supplies of yard-manures. Procrustean principles are inconsistent with good farming, which ought to accommodate itself especially to changing conditions of markets and cost of production. If customers fail to bid for the crops at Blount's Farm or Blunsdon, the auction sales can be discontinued and the corn harvested by the growers. The straw, if not required to fodder and litter stock, can, as now, be disposed of for paper-making and other purposes, at prices considerably above the 16*s.* or 18*s.* per ton, which it is worth merely for manure. Again, even supposing that liberal foreign supplies bring the cereals down to a selling point at which their growth ceases to prove remunerative, these farms, so deeply and cleanly cultivated, are in an unusually favourable state for growing full crops of roots and fodder, and maintaining a large amount of stock. Meanwhile, Messrs. Prout and Middleditch's valuable experiences inculcate various practical lessons applicable almost to any system of farming. They inculcate the wide adoption, especially on the heavier clays, of the deeper and more effectual stirring of the soil; the economy of steam, as compared with horse-power, in the cultivation of the land; the more systematic liberal feeding of the farm-crops with portable manures; the gain resulting from drilling such manures with the seed-corn, and thus bringing them into closer contact with the spongioles of the young plants; and the desirability of remunerating the tenant for unexhausted improvements effected by his own capital, and thus encouraging him to devote to his vocation more brains, enterprise, and money.

III.—*The Labour Bill in Farming.* By Frederick Clifford.

For some months during the year 1874 it became my duty to follow somewhat closely the strikes and lock-out which occurred in the Eastern Counties, to describe the course of farming there, and set forth fairly the position both of employers and employed. The present Paper has not for its object a discussion of any of the controverted questions which arose during that unhappy struggle. Those persons who care to revive their recollections of what will always be a memorable event in the history of English agriculture may refer elsewhere to a perma-

nent record of the strikes and lock-out.* It has been thought, however, that one point of practical interest to British farmers, suggested by the events of 1874, might be treated in this 'Journal,' with greater fulness than was necessary or possible when these events were described merely for general reading, and might possibly result in some advantage through a frank discussion of the labour question here. Having no claim whatever to the character of a practical farmer, I had, and still have, much hesitation in venturing to speak upon a question of this nature to readers who will be for the most part experts, thoroughly acquainted with details, which I can give only at second-hand. As, however, I have been asked to place upon record in the 'Journal' some of the facts and statistics, gathered in the course of my enquiry in East Anglia, as far as they relate to the Labour Bill in farming, I do so, though with diffidence, accompanying them by such reflections as suggest themselves to an outside observer, not an expert, who has watched with great interest, and under exceptional conditions, the attempt to solve a problem of the highest public importance.

The farmer's position is in many respects a peculiar one, and must be properly appreciated before we can hope to understand the question now proposed for treatment. It is his business to produce for human sustenance as much animal and vegetable food as his land will raise, and to produce it at the lowest possible outlay consistently with fair dealing towards landlord and labourers. Some advantages belong to the position. Rural life is pleasant, and hitherto has been easy-going, though whether it will long continue so is doubtful. The farmer breathes pure air, is seldom weighed down by too much work, has a healthy outdoor occupation, can take his share of field-sports. It has often been said that he begins life with an employment, and amid scenes, which townspeople covet all their days, and hope only to enjoy as the final reward of long and successful work. Then the farmer has not to face the keen competition of neighbours; nor is he tempted to resort to the sharp practice which, as he reads, is but too common in the towns, in order to maintain your position relatively to that of trade rivals. What his neighbour grows, or how much, is nothing to him, except that he naturally likes to farm as well and grow as much. In agriculture there is an absence of anything like trade jealousy, trade secrets, over-reaching, or unfair rivalry. Farmers have interests in common; and such competition as exists among them is a generous

* 'The Agricultural Lock-out of 1874, with Notes upon Farming in the Eastern Counties.' Reprinted from 'The Times.' By Frederick Clifford, of the Middle Temple, Barrister-at-law. William Blackwood and Sons, Edinburgh and London, 1875.

competition, springing from a wholesome desire to distinguish themselves in what is by far the largest and most important of national industries. Then, too, there is no need for the farmer to solicit custom. He produces articles in universal demand, for which he is sure to receive the market price, whether remunerative or unremunerative, without going farther than the next market-town. He need not advertise, or employ agents to tout for him, or be at all anxious about the sale of his commodity, though he may have great cause for anxiety about the price it fetches. He does not stand beholden to any customers, or fear the loss of orders from this man or that; nor has he to reckon from time to time upon possible sudden, capricious checks to demand, through changes in habit or taste, or through the competition of foreign manufactures in foreign markets. He is wholly independent of foreign markets, and is absolutely certain of a demand for all his produce at his own barn-door, without incurring the smallest obligation to the buyer, or going cap in hand to anybody.

There is another side to this picture, and it is a much less pleasant side. The farmer carries on his business under conditions which often render skill and industry wholly unavailing to secure success. He deals with land which may be unthankful. He must face the seasons, over which he has no control. Crops, to the growth of which he may have contributed all that good husbandry and unceasing care require, may fail to fulfil their early promise. From year to year his land yields varying quantities, over which his toil and thought and outlay have little influence. Then his cattle and sheep suffer from diseases which, of late years, have come to be far more fatal and frequent than they used to be, while he is equally powerless to prevent them. If, like most manufacturers, he were able to recoup himself for losses by raising prices—or if, like some other producers, he could combine to keep up prices—his position, economically, would be vastly improved. But a farmer's is a cosmopolitan trade. He does not feel that he has rivals in his neighbours, because farmers throughout pretty nearly the whole world are his rivals, and therefore the cereal produce of his parish, or even of his county, is not worth considering in its effect upon the price of his own produce. At present, indeed, he has to a large extent a monopoly in the supply of beef and mutton, though before many years are over we may be sure that science will find the means of cheapening this commodity by importing it in much larger quantities, and in a more palatable condition, from countries like Australia and South America. As to wheat, however, which hitherto has been the staple crop of the British farmer, he must measure himself against producers in countries where taxation is light, where the seasons are favourable, where the

land has a natural fertility far surpassing that of the British isles, and perhaps labour is far cheaper. Happily for consumers, distance, and the difficulty of transit, is the only protection enjoyed by the home producer; and the price of wheat depends not upon his will but upon the genial rain which quickens, and the sunshine which is sure to mature the crop, if not here, at any rate in some of the countries that are ready to supply us with their superabundance.

It will thus be seen that the British farmer, who, like other men, follows his calling for profit, is limited in his power of making this profit by natural conditions not applicable to ordinary producers, while from these conditions he can never hope to be free. We are also face to face with the fact that the ordinary business of farming is not one in which high profits are made. If, on an average of years, he makes from eight to ten per cent. upon his capital, he may be reckoned fortunate indeed. There may be some farmers, exceptionally favoured in respect of rents and quality of soil, whose percentage of returns is larger; but I suspect there are very many more who cannot point to so large a return. In few trades would this rate of interest be deemed an adequate one, considering the risk run and the skill and amount of personal supervision necessary. The farmer cannot turn over his capital three or four times in the course of a year. On the contrary, he has to spend so much for rent, for labour, manure, and seed, long before he receives any return for this outlay; and whatever profit he makes must be led up to by a long course of industry, by continued expenditure, and patient expectations very often bitterly disappointed.

If, however, the British farmer, as a rule, makes at the best only three or four per cent. above the rate of interest he would receive, with little risk, if his capital were invested on the mortgage of house property, and no more than he would receive in many modern investments, reckoned fairly safe, leaving no remuneration for his personal services upon the farm, the question now to be considered is an urgent one. It seems to be capable of statement in this way:—Labour is one chief item in farming outlay. Its tendency, shown by recent events, is to rise in value. From a public point of view, as well as in the interests of a class with whom we must all sympathize, it is desirable that labour should rise in value; but the farmer, like the labourer, must live. Some persons, indeed, on this point have replied almost in the words of the French wit, who, when a similar appeal was made to him, said, "Je n'en vois pas la nécessité." But as rural society is now constituted, and under our present system of agriculture, it must be assumed that the land is meant as much for the support of the farmer as the labourer.

As few farmers, therefore, till the land for the purpose of pleasure or experiment, can they, with the existing narrow margin of profit, get a living if the cost of labour materially increases?

Clearly they cannot do so, unless by compensation derived from one or more of the following sources:—(1) by lower rents, a result which cannot be reasonably looked for; (2) by higher prices for farm produce; (3) by increased production; (4) by greater economy in production, such as through the cheapening of manure, the reduction of local rates, the increased use of machinery, and resort to a course of husbandry requiring less labour; or (5) by a system of paying for labour by results,—a system which recognizes the necessity of higher wages, but requires in return labour, if possible, higher in quality and certainly greater in quantity than that now given.

I have said that lower rents cannot in reason be expected. Whatever may be the case in Scotland, one cannot have gone far, or made much enquiry as to rents on this side of the Tweed, without feeling that land is on the whole very fairly, and even moderately let. Some time ago an Eastern Counties farmer had an interview with a landlord, who was talking of proposed changes upon a large estate where the tenantry were not very contented and not very prosperous. The farmer, as he told me, contributed his suggestion, though it was a negative one:—"For goodness sake, sir," he said, "whatever you do, don't lower the rents!" He meant, no doubt, that rent acts as a healthy stimulus to exertion, and that rentals below the fair value of the land let are sometimes no real advantage to indifferent farmers. I daresay the landlord took kindly to the advice thus tendered. However this may be, English tenants must look first to help from one of the other sources just indicated. Farming must be proved to be unprofitable, after other shifts have been tried, before rents will come down; and they are more likely to go up than to come down.

Higher prices for farm-produce are more within the range of probability. Wheat is now very low, and men of experience look for a continuance of low prices for bread-stuffs. Barley is taking the place of wheat as a remunerative crop upon suitable soils. The average price of farm-produce may now be said to be a fairly good one, and in time other crops will be substituted for wheat. This is a topic, however, with which I shall not presume to deal. The possibility of increasing production, and reducing absolutely or relatively the cost of production, also raises questions beyond the scope of this Article. We come, then, to the last of the five heads just specified—the Labour Bill.

At starting it will be well to try to define as nearly as possible

what may fairly be included in the "Labour Bill" in farming. The nominal rate of wages paid in a given district, as even the most superficial readers of newspapers now know, represents as a rule neither the labourer's full gain nor the farmer's entire outlay in this branch of expenditure. The items which really contribute to this expenditure may be classed as follow:—

1. Weekly wages for manual labour.

2. Labourers' extra earnings from piece-work, not including harvest.

3. Extra wages at harvest, whether paid by the week or in a lump sum for the job.

4. Horse labour, including risk and depreciation.

5. Difference in the value of cottage and garden, where these are let by the farmer or his landlord to the labourer rent-free, or at rentals below actual value.

6. Perquisites given directly or indirectly as a supplement to wages.

7. Wages knowingly paid by the farmer in excess of the value of the labour given in return, as in the case of old or infirm hands.

8. The farmer's contribution in rates to the relief of the poor.

1. "The price of labour," writes one of my correspondents, "as well as the rent of land, must be governed by this fact—whether the farmer's capital is profitably or unprofitably invested." The truth of the proposition may be admitted; but then the farmer must move with the times, and use the means which experience and necessity from time to time suggest for adapting his mode of husbandry and employment of labour to the social or economical changes which occur around him. In the end, self-interest will lead him to do what he finds it is necessary he should do for the purpose of insuring a profit on his capital; but it is well that no time should be lost in getting into the right groove. Let us now see what the cost of labour is and has been in farming during recent years, and what seems to have been the influence of machinery upon the charge for manual labour.

The old-fashioned way of estimating the cost of manual labour was to take it as about equal to rent and tithes. Now, however, the cost of labour is regulated by the system of farming pursued upon the various occupations. Some forty years ago, before artificial manures came into use, a farmer depended almost entirely upon such manure as he could produce at home. This, again, ruled the number of acres under crop, and the bulk of each crop, and it ruled also the demand for labour. The use of artificial manures greatly increased the number of hands employed. The introduction of machinery set free some hands, but generally to

employ them only in other ways. For example: "Forty years ago," writes Mr. Mathew, of Knettishall, near Harling, "six men upon this farm did nothing but thresh corn from harvest till June 1st in the succeeding year. Now I do not use a flail at all, and still I employ more men than were employed here forty years ago, though I grow no more corn: indeed the acreage of corn is now rather less than it was then. Machinery does not lessen the demand for manual labour, but diverts it into other channels. In some districts the value of labour used to be calculated by the price of wheat; and the price of one bushel of wheat, added to half-a-crown, was the weekly wage paid for an adult labourer. Thus, when wheat was selling at 30*s.* per coomb (4 bushels), the wages would be 10*s.* a week. During the Crimean war, wheat rose to 44*s.* per coomb, and the farmers in my parish then advanced wages to 13*s.* per week. At that time a great many men were out of work."

The following is the LABOUR ACCOUNT upon a Light-land Farm in Suffolk, containing 367 acres arable land, 23 acres pasture, and 37 acres sheep walk:—

Date in May.	Daily Wage of able Men.		Amount paid for Labour annually.			Cost of Labour per acre upon 400 acres.*		
	s.	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
1847	2	0	565	15	6			
1848	1	8	623	8	5			
1849	1	6	557	6	9	1	7	10¼
1850	1	6	535	7	8			
1851	1	4	507	2	3			
1852	1	4	494	19	6	1	4	6¼
1853	1	6	526	0	8	1	6	3½
1854	2	0	660	8	4			
1855	2	0	676	19	5			
1856	2	0	757	11	11			
1857	1	10	692	13	10	1	14	7½
1858	1	8	674	6	2			
1859	1	8	647	4	4			
1860	1	8	696	18	8			
1861	1	10	727	3	9	1	16	4¼
1862	1	10	689	19	4			
1863	1	8	689	14	5			
1864	1	8	638	0	6			
1865	1	8	605	16	10	1	10	3½
1866	1	8	640	16	0			
1867	1	10	681	2	11			
1868	2	0	721	19	2			
1869	1	8	652	0	9	1	12	1
1870	1	8	616	13	9			
1871	1	8	618	15	7			
1872	2	0	694	10	4			
1873	2	2	700	18	5	1	15	0½
1874	2	2	719	12	7			

* This calculation allows a little labour for the sheep-walk.

The above figures represent the amount paid in hard cash. The value of the beer given was about 15*l.* or 20*l.* annually, according to the price of malt. Beer is given on this farm all the year round, at hay-time and harvest, as well as during drilling, sheep-washing, and clipping. Then there is the meat, &c., given to the men at sundry times from the house. To this may be added cheap cottages, let at 52*s.* and 3*l.* per year, allotments free, meat and beer at Christmas according to the size of the family; and three-quarters day given on Good Friday.* The reason of the year 1847 showing so small a gross amount of wages is accounted for by the fact that the out-going tenant paid for his own threshing.

A valuable addition to the foregoing statement is the following:

Account of Wheat and Barley Crops upon the same Farm, and their Average Prices, together with the Weekly Wage paid to able-bodied men during the same periods.

	Wheat Crop. Average.			Price per Coomb.		Barley Crop. Average.			Price per Coomb.		Weekly Wage.	Profit or loss per cent. on Capital.
	C.	B.	P.	*s.*	*d.*	C.	B.	P.	*s.*	*d.*	*s.*	
1849	9	1	0	19	0	10	2	0	14	0	9	
1850	8	0	0	20	6	10	0	0	11	0	9	
1851	8	0	0	20	0	11	0	0	14	6	8	Profit, 5¾ per cent.
1852	7	2	0	23	6	11	2	0	16	0	8	Profit, 10 "
1853	7	2	0	42	0	11	0	0	19	0	9	Not a farthing profit.
1854	13	0	1	36	0	13	0	0	17	0	12	
1855	8	1	2	38	0	13	2	0	19	0	12	
1856	8	3	0	35	0	11	3	0	23	0	12	
1857	9	1	1	25	0	12	0	0	19	6	11	
1858	9	0	1	23	6	9	2	3	17	0	10	
1859	9	1	2	24	0	9	3	1	13	6	10	
1860	8	0	0	27	0	11	0	2	24	0	10	
1861	9	1	1	30	3	11	0	0	20	6	11	
1862	7	0	3	24	3	11	0	1	18	6	11	
1863	10	3	1	20	6	12	3	2	18	0	10	
1864	7	0	0	20	6	11	3	2	16	0	10	
1865	9	3	3	23	0	8	2	3	17	6	10	
1866	9	1	1	28	0	10	1	0	23	6	10	
1867	9	0	0	35	0	11	0	0	20	6	11	
1868	8	3	3	26	0	9	2	0	23	6	12	
1869	10	1	1	22	0	9	0	0	17	0	10	
1870	6	0	3	27	9	6	2	1	17	9	10	Profit, 10 per cent.
1871	8	0	1	29	0	11	0	3	19	6	10	" 7 "
1872	7	0	3	26	0	9	2	2	22	0	12	" 9 "
1873	7	2	1	31	0	9	2	1	24	0	13	" 12 "
1874	..			..		..			..		13	

The corn averages are rather high in price, because, as a rule, none of the dross corn was sent to market, but was kept for consumption on the farm. The figures are trustworthy, and are of

* The value of these extras is reckoned by the farmer at 1*s.* 6*d.* per acre.

interest, not only as showing the varied yield of crops upon a well-cultivated farm, but as showing also how far the wages here have followed the rise or fall in the price of corn. The existence from time to time of surplus labour in the district is another disturbing element.

The details that follow relate to a farm of 780 acres, of which 38 are wood, 20 pasture, and 722 arable. Of the latter about 5 per cent. would be waste. Part of the land is light; part is good mixed soil. The rent is 1080*l.*; the tithes, 224*l.*; rates, 106*l.* The year's labour bill was 1330*l.*, representing about 34*s.* per acre. The tabular figures show the total paid for labour upon the farm during the last 17 years, and they show also the amount given in beer. A good deal of difference will be observed in the cost of labour from year to year, even when the rate of wages is the same. This difference is caused by the variation in seasons, much less labour being required in a dry than in a wet season. Indeed, the effect of a drought in reducing wages sometimes extends into the year following, owing to shorter crops to be gathered, and a smaller quantity of corn to be threshed. It will be seen what little difference seems to have been produced by the latest agricultural machinery in reducing the total wage account. Steam-threshing caused a considerable economy in labour as compared with flail-threshing, but this result is not shown, as steam-threshing was adopted upon the farm before 1857, when the figures begin :—

TOTAL LABOUR for the YEARS ending OCTOBER 11.

	Total Labour.	Including Beer.
	£ s. d.	£ s. d.
1857	1,266 19 0	55 12 0
1858	1,192 5 0	54 5 0
1859	1,221 14 0	82 5 0
1860	1,298 18 0	55 13 0
1861	1,265 10 0	54 15 0
1862	1,330 17 0	87 18 0
1863	1,119 6 0	35 17 0
1864	1,076 0 0	31 2 0
1865	1,040 18 0	85 2 0
1866	1,158 5 0	*
1867	1,275 2 0	117 7 0
1868	1,244 6 0	134 2 0
1869	1,126 17 0	93 5 0
1870	1,165 15 0	78 13 0
1871	1,043 11 0	50 2 0
1872	1,199 4 0	61 4 0
1873	1,318 17 0	11 6 0

* Beer omitted by mistake.

One cause of the great variation in the value of the beer given

is that a quantity of malt or beer was in stock at the beginning of some of the years. The fairest way, therefore, would be to take the average of groups of years. It will be seen that, happily, since the *maximum* was reached in 1868, the quantity has been steadily diminishing. The following account, derived from the labour books kept at this farm, shows the fluctuation in the nominal rate of wages paid there during a period of 58 years:—Between 1817 and 1821, inclusive, the wages paid were 10*s.* a week; 1822–3, 8*s.*; 1824, 9*s.*; 1825, 10*s.*; 1826–30, 9*s.*; 1831–3, 10*s.*; 1834, 9*s.*; 1835–42, 10*s.*; 1843–6, 9*s.*; 1847, in May, 12*s.* (Irish famine), November, 10*s.*; 1848–9, 9*s.*; 1850–2, 8*s.*; 1853, 9*s.*, in December, 10*s.*; 1854 (March), 11*s.*; 1855, 11*s.*, in December, 12*s.*; 1856, 11*s.*; 1857, 10*s.*; 1858–60, 9*s.*; 1861–2, 10*s.*; 1863–5, 9*s.*; 1866, 10*s.*; 1867-8, 11*s.*; 1869–71, 10*s.*; 1872, 11*s.*, in October, 12*s.*; 1873, 12*s.*, in April, 13*s.*; 1874, 13*s.* At this nominal wage of 13*s.* an average able-bodied labourer on the farm earned the following actual wages, from May 3, 1873, to May 2, 1874. He enjoyed no advantages in day-work, for which extra pay is allowed as in some instances, and was never employed on Sundays in looking after horses and stock. During the year this man lost two and a half days through absence, besides a little time taken by him at his own request before and after harvest; but he earned by day-work 24*l.* 12*s.* 9½*d.*; by piece-work, 13*l.* 0*s.* 6½*d.*; and by harvest-work, 8*l.* 15*s.*—total, 46*l.* 8*s.* 4*d.*, or rather more than 17*s.* 10*d.* a week in cash. Then he had the following perquisites:—A house and good garden, for which he paid a shilling a week, but which was valued by the farmer at the moderate rent of 4*l.* 10*s.* In the outskirts of a town it would be thought a catch at 9*l.* The farmer, however, only put down as the difference between rent paid and actual value of cottage, 1*l.* 18*s.* The beer perquisites came to 1*l.* 6*s.*; fagots, 2*s.* 6*d.*; coal, 10*s.*; Christmas-box, 2*s.* 6*d.*—value of perquisites, 3*l.* 19*s.* Total value of earnings and perquisites, 50*l.* 7*s.*

Here are some details respecting a farm of another class, a small one of 200 acres, mixed soil, with 3 acres pasture, and the remainder arable, the estimate of waste being 7 per cent. The amount paid in labour during the year was 426*l.*, or 2*l.* 2*s.* 7*d.* per acre. It will be seen that upon the farm nearly four times its size, just mentioned, the cost of labour was 8*s.* 7*d.* per acre less. Besides men and boys, 8 horses are required to work these 200 acres. The rent was 335*l.*; tithe, 83*l.*—total, 418*l.* The wages paid to ordinary labourers were 13*s.* for five weeks in the year, 14*s.* for 43 weeks, and then come the four weeks of harvest, which make the average earnings throughout the year 17*s.* weekly in cash. The horsekeeper and stockman receive

each 2*s.* a week extra. The beer perquisite is not included in this calculation. The farmer here had allowed his books to be examined by an independent person, from 1862 to 1871 inclusive, for the purpose of estimating profits, and during these ten years the profits amounted to 2671*l.*, or an average of 267*l.* for interest on a capital of 2500*l.*, and also as the return for no common skill, and for constant care and oversight. My informant argued that a net profit of 267*l.* afforded very little margin for allowing an increase of wages, and upon such returns as the farming of 1874 produced there is no margin at all. Since 1871, as will be seen by the Table just given, agricultural wages have risen 3*s.* weekly—from 10*s.* to 13*s.* The labour on this 200-acre farm during the ten years (1862–71) amounted to 3236*l.*—an average of not quite 324*l.* per annum; but in 1873–4 the labour bill was 426*l.*, showing an increase of 102*l.* If this 102*l.* can be replaced by higher profits than were shown from 1862 to 1871 the farmer cannot complain, but at present prices he can have no such expectation. The sum of 102*l.*, then, must be viewed as a permanent deduction from the average yearly profit, bringing it down to 165*l.* per annum; "and I ask you or any reasonable being," said the farmer, "whether that is a fair remuneration upon my 2000*l.* capital, and for a fair average amount of skill and strict personal attention?" The good faith of the farmer in this instance is undoubted; and his statement throws some light on the question as to the margin of profit out of which farmers can afford to satisfy the demand for increased wages. In refusing to increase wages the farmer does not always withhold something which he can well afford to pay.

The following figures refer to a heath farm of 950 acres, of which about 525 are arable and 130 pasture. It was taken by the father of my informant in the year 1834. At that time there was not a machine on the farm, excepting such as were worked by hand. Shortly afterwards, however, the occupier bought a horse-power chaff-cutter. Some of the farm books between 1834 and 1842 are lost, and therefore the separate amounts under the subjoined heads for those years cannot be supplied. It may be stated, however, that the labour bill for the year 1835 did not amount to 500*l.*—less than 20*s.* an acre upon the arable land alone, and between 1834 and 1842 the outlay for wages may be fairly put at an average of 550*l.* The farm has been cultivated strictly on the four-course shift, so that the same acreage of corn has been maintained, except during the last five years, when the present occupier has been farming upon a system which involves the growth of less corn and the substitution of green crops. On the other hand, in the year 1867, 147 acres of arable land were added to the farm, which is now larger by that acreage:—

Year ending	Labour.			Cake Corn, Manure, &c., purchased.		
	£	s.	d.	£	s.	d.
1843	627	0	0	300	14	6
1844	620	8	10	482	12	4
1845	597	19	1½	482	12	4
1846*	556	2	4	577	15	10
1847	690	14	3½	676	9	9
1848	623	6	7½	760	7	0
1849	646	10	10	711	0	6
1850†	592	6	0	556	11	5
1851	569	15	4	682	11	4
1852	555	2	1	617	11	7
1853	624	1	4	755	1	3
1854	736	3	2	991	14	10
1855	797	7	8	1,250	15	5
1856	775	18	1½	1,210	15	9
1857	767	11	1	622	1	0
1858	731	12	7	980	17	11
1859‡	749	2	11	983	1	11
1860	794	5	8	915	1	3
1861	814	2	1	1,159	18	11
1862§	785	10	6	1,368	14	11
1863	766	2	8	1,220	1	0
1864‖	712	4	1½	1,189	14	4
1869	906	7	0	995	19	10
1870	916	3	6	1,010	9	6
1871	879	15	1	907	12	6
1872	943	10	0	1,104	6	2
1873¶	964	3	8	820	15	0

The year ending September, 1874, would show an addition to the labour bill of about 100*l.* The fact prominently brought out by these figures is one already indicated—that the introduction of machinery and of high farming increases the demand for manual labour instead of diminishing it. During the later years covered by these statistics, machine-reapers and mowers, and root-mincers have been used, and steam-power has been employed in threshing and for other purposes. Yet the money spent in manual labour has hitherto gradually increased. On the other hand, the number of horses has been gradually reduced from 19 in 1868 to 15 at the present time by the use of double ploughs, and by keeping more land down in sainfoin. The farmer, too, is employing six men fewer than in 1873. This reduction of staff is in part due to the dry season of 1874, but the farmer, being put to the test during the lock-out, is of opinion that he

* Guano first tried and Lawes's turnip manure first used.
† Horse-power threshing-machine bought, and nitrate of soda first tried.
‡ Reaping-machine bought this year.
§ Steam threshing-machine purchased.
‖ There is a break in the account here till 1869.
¶ Ending September 1.

can permanently reduce the regular staff of men in his service. Here is a statement of the earnings of his labourers during the last 12 months. I may pass over the bailiff, the shepherd (more than 70 years old), with assistant, and the groom:

J. B., over 70 years old, 2*s.* per day, extras when at piece-work; cottage, 2*l.* 10*s.* rent. He has harvested on the farm for 48 consecutive years.
J. W., over 70 years old, 11*s.* per week all the year round, and extras for an odd job.
S. D., eight years on farm, head man, 50*l.* 1*s.*; no rent.
W. J., four years ditto, second man, 48*l.* 10*s.*; single man.
W. S., 60 years ditto, general work, 44*l.* 12*s.*; 8*l.* rent.
J. B., eight years ditto, acre work, 50*l.* 12*s.*; no rent.
H. L., four years ditto, acre work, 47*l.* 2*s.*; no rent.
R. F., from a boy, thatching and general work, 48*l.* 6*s.*; 2*l.* 10*s.* rent.
J. F., from a boy, machine, cart, &c., 49*l.* 10*s.*; 3*l.* 1*s.* rent.
C. S., seven years on farm, general work, 45*l.* 17*s.*; 3*l.* 10*s.* rent.
D. H., eight years ditto, machine work, &c., 47*l.* 5*s.*; cottage in another parish, one acre of land.
J. W., jun., life ditto, stockman, 48*l.* 9*s.*; 3*l.* rent.
C., about 30 years ditto, engine-man, 47*l.* 6*s.*; no rent.
W. from a boy ditto, general work, 44*l* 16*s.*; 2*l.* 15*s.* rent.
H. B., four years ditto, general work, 47*l.* 8*s.*; single man.
J. C., worked through winter upon estate work.
J. S., worked through winter, and then left without giving notice.
H. E., from a boy, now about 20, has had 13*s.* per week, and extra in harvest, &c.
W. C., about 18, has 12*s.* per week, and extra in harvest, &c.
J. D., about 18, left and went to Leicestershire, returned again, did not find it answer, has 2*s.* per day, &c.
C., age 16, 7*s.* per week, and extras, &c.
G. F., age 15, 6*s.* ditto, ditto.
J. F., age 13, 4*s.* ditto, ditto.
W. S., age 14, 5*s.* ditto, ditto.
H. S., age 14, 6*s.* ditto, ditto.

In looking through the labour books on the farm just mentioned, I find that nearly one-half the outlay for horse and hand labour is incurred during the spring and summer in growing food for stock. Again, during the winter months more than one-half the labour is employed in looking after the cattle and sheep on the farm and in preparing food for the stock. Modern farming differs from old-fashioned farming chiefly, perhaps, in the greater quantity of stock fed and sent to market. The farmer finds that, to make a living, he must not, in common talk, "look to the barn-door for everything." Wheat is not the remunerative crop it used to be. On some land in Suffolk perhaps the best barley in England is grown, and the Burton brewers are ready to give good prices for it. But, unless the soil is one peculiarly adapted for white-straw crops, the farmer now must breed or feed, or breed as well as feed. The increase of stock accounts to a great extent for the fact, that with the increased use of machinery has come a

greater demand for manual labour in high farming. What has just been stated as to the farm I am now noticing—that of Mr. Mathew, of Knettishall—shows that during three parts of the year the stock is properly chargeable with quite half the labour employed. Forty years ago Mr. Mathew's father, who then held the farm, grew as great an acreage of corn as is now grown, and did not employ so many men and boys, nor any machinery for the first ten years of his occupation, though he employed more horses. One explanation is that he only kept about half as many sheep as are now wintered on the same farm, and about half as many head of neat stock. All the corn on the farm is now threshed by steam. Steam machinery is used for cutting chaff and grinding corn, and horse-power for mincing roots and breaking cake. All this work used to be done by hand, yet the father employed fewer labourers than the son now employs, and the father's expenditure for labour continued for some time at the rate of about 500*l.* a year, whereas the son, who uses all this steam and horse power, is spending (with 150 more acres, it is true) 1100*l.* in manual labour.

Mr. Mathew is sowing less corn and trying a system which he hopes will make farms of light and mixed soil more self-supporting, by rendering them less dependent upon artificial grasses, and reducing some of the present heavy items for expenditure upon cake, artificial manure, and labour. This is one of the changes already indicated for economising production. He has found that, upon light land, sainfoin resists the drought better than most other descriptions of feed, and he also attaches great importance to the growth of a good plant of mangolds. Assuming, therefore, that he thinks it right to grow 20 acres of mangolds every year, the course of husbandry upon six plots of 20 acres each would be as follows:—1. Mangolds after barley, instead of small seeds. 2. Wheat after mangolds in course. 3. Sainfoin after wheat, instead of turnips. 4. Sainfoin instead of barley. 5. Sainfoin instead of clover, &c. 6. Wheat after sainfoin, in course. The 3-year-old sainfoin is followed by wheat, and there is always an acreage of sainfoin of three different ages upon the farm. This crop, it is said, supplies capital feed, whether cut for hay, or used in the yard for horses and cattle during the summer, or given as chaff, or fed off on the land. The acreage so occupied requires no manure and little labour, and possesses other advantages which, in the farmer's opinion, more than compensate for the loss of 20 acres of barley. Here is the yield upon a field of 16 acres of sainfoin during three consecutive years:—1868. First crop of hay, 33 waggon-loads; second crop fed off by lambs. 1869.—First crop of hay, 35 waggon-loads; second crop, 80 sacks of seed. 1870.—First

crop of hay, 33 waggon-loads; second crop, seed estimated at 224 bushels. Practical men must judge for themselves as to the merits of this system. The farmer is convinced that it is, at any rate, well adapted to his own land; and he expects, by means of it, to dispense with four men and four horses when it is in full operation, besides greatly increasing his food for sheep and cattle, and thus growing more corn upon the fields which are cultivated for corn, to compensate him somewhat for the smaller acreage of corn which his system involves. One point upon which Mr. Mathew insists is, that any falling off in the supply of labour, whether from a strike, a lock-out, or from natural causes, will reduce the supply of meat rather than the production of corn. From April 1 to the end of July, about one-half of his men were employed in growing roots and getting in the hay—in fact, in producing a supply of winter food for sheep and cattle; and from the completion of harvest to April again, one-half the men and boys were engaged in securing roots, cutting chaff, mincing and preparing food, littering yards, and attending to sheep and cattle. Thus the winter's work is regulated to a great extent by the operations of the spring and summer, and, summing the matter up in the farmer's words, "Few men in spring and summer, mean few roots or little hay. This again means no stock during autumn and winter, and no stock during autumn and winter means 14 fewer men and boys than I employed last year."

The moral drawn by Mr. Mathew is, that if the labour market is disturbed by any cause, the first to suffer is the labourer, the next the consumer, while the last and least sufferer is the farmer. After planting his spring corn comes the season for planting mangolds and kohl rabi, which may be done up to the 10th of May. If that season is lost, so is the crop. Agricultural work is not like manufacturing work, which can be taken up where it was left off. The season once lost in farming is lost for ever.* You must try something else. Supposing, then, that mangolds and kohl rabi fail, swedes can be sown up to the 10th of June. If this time goes by, you need not sow, for you will get no crop. White turnips, however, may follow up to the 18th of July. If this season be missed through dearth of labour, the farmer will take to coleseed, which requires little or no labour. What, then, is the relative value of these crops? Mangolds will carry one-third more stock than swedes, swedes will carry more stock than white turnips, and each of these crops will carry as much stock again as coleseed. The earlier crops

* "Res rustica sic est, si unam rem serò feceris, omnia opera serò facies."

of the year require the greatest amount of labour—wheat more than barley, mangolds more than swedes, swedes more than turnips, and turnips more than coleseed, which "may be fairly termed the farmer's refuge." These are the premises upon which Mr. Mathew justifies his conclusion that the farmer can carry on his business, dispensing with much labour, and leaving the labourer and consumer to be the chief sufferers. As to another course open to the farmer—to lay down more land in grass—he does not doubt that this may and will be done; but adds, "it may increase the quantity of store cattle and sheep, but, I think, it will not materially increase the quantity of fattened sheep and cattle. In my opinion, no greater quantity of stock is fattened under any system of farming than under the old four-course system, which has stood the test of several generations."

I will now give the labour outlay upon three farms in a state of high cultivation in Cambridgeshire and Suffolk. The first consists of 1076 acres, of which 162 are heath, 50 pasture, and 864 arable, the arable land comprising 384 acres of light and 480 of strong land on chalk. The net rental received by the landlord (free of Property Tax) is 1477*l.* The gross rental paid by the tenant, including Land Tax, tithes, rates, and taxes, is 2012*l.* The amount distributed in cash for labour during the year ending Lady-day last, was 1453*l.* Besides this sum, the farmer, at harvest time, gave his men malt and hops worth 68*l.* 14*s.*; the harvest supper cost him 9*l.* 13*s.*, and he estimates the beer given during the remainder of the year at 37*l.* 15*s.*, making an addition to the labour bill of 116*l.* 2*s.*, or a total of 1569*l.* During the same period, the sum of 2414*l.* 16*s.* was spent in feed and manure, making a total outlay of close on 6000*l.* The farmer here has carefully worked out his profits during the seven years he has cultivated his present holding, and, after debiting his house-keeping account fairly with every article of farm produce consumed, he says he has only made 7 per cent. on the capital employed, about 9000*l.* I may add that he farms under lease, and therefore enjoys security of tenure. On another farm of 800 acres, rent and tithe came to 1130*l.*; cost of labour, 1775*l.* This farm consists of light, easy working land, with only 10 acres of pasture, the remainder being arable. On another farm of 370 acres (300 arable, mixed soil, and 70 pasture) the rental is 50*s.* per acre, including tithe and rates; the charge for labour is 37*s.* 6*d.* per acre; the average earnings of the labourers are 17*s.* per week in cash, and the perquisites or extras are reckoned at about 3*s.* per acre.

At Blennerhassett, the whimsical co-operative farm carried on

by Mr. Lawson, the labour sheet for one year showed the cost of labour to be *3l. 5s. 2d.* per acre, another year *2l. 2s. 6d.*, while the cost of farm-horses is put down at *43l. 18s. 9¾d.* per annum. No wonder the experiment proved a financial failure. Against this instance of frolicsome farming, full of interest and amusement as it is to Mr. Lawson's readers, let me set some figures taken from the accounts of a heavy-land Eastern Counties farm of 367 acres, cultivated for profit and not as a social or farming experiment. These figures have been carefully prepared for my use in these pages, and show, upon a moderate holding, highly farmed and closely looked after, the proportions borne by wages to other outgoings in the Eastern Counties, during the last eight years.

Upon the 367 acres, the waste by house, garden, premises, hedges, ditches, &c., would be 17 acres. Of the 350 remaining acres, 29 would be in pasture and 321 arable; roots grown would average—mangold from 15 to 20 acres; swede turnips, 15 acres; kohl rabi, 4 acres; and the remainder white turnips.

The farmer does not debit himself in his accounts with any allowance for depreciation upon machinery and implements. It is clear, also, that his profits cannot be safely tested unless we assume that on leaving the farm his live stock will fetch the price he paid for stock on entering the farm. In other words, we must assume that his capital will be returned to him in full by the incoming tenant. Subject to these remarks, we seem to have here an instance of successful farming, to be accounted for in part by the quality of the land and probably also by the manageable size of the farm, which renders close personal supervision possible.

r.	Balance of Receipts over Payments.*			Cost of Labour.			Rent.			Rates and Taxes.			Other Payments, including Interest.			Total Payments.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
66	251	10	0	522	15	11½	502	12	2	94	0	10	1095	10	6	2214	19	5½
67	798	13	1	567	2	7½	516	15	3	100	8	0½	1118	15	0	2303	0	11
68	413	15	0	601	17	6½	532	7	3	112	11	8½	1233	9	3	2480	5	9
69	84	18	10½	563	9	8½	552	4	0	82	5	10	1286	13	3	2484	12	9½
70	445	19	2	579	13	2	552	4	0	101	6	6	1497	8	1	2730	11	9
71	507	11	6	560	1	6	552	4	0	76	19	5	1972	13	3	3161	18	2
72	394	1	9½	664	7	8½	552	4	0	87	13	8	1831	0	6½	3135	5	11
73	240	7	11½	716	4	4	548	19	0	70	7	3½	1474	5	8	2809	16	3½
ge	392	2	2	596	19	1	538	13	8	90	14	2	1438	14	5	2665	1	4½

* After deducting interest of £3800 at 4 per cent.

The average profit, during the eight years, was 392*l.*, besides the interest at 4 per cent. charged in the balance sheet. A capital of 3800*l.*, therefore, returned in this instance over 14 per cent.; a financial result which I believe to be exceptionally favourable. It will be seen that the cost of labour has risen considerably during the two years last given, and 1873-4 would yield a still higher labour bill. Diminishing profits during the same period seem also to show that the increased wage-fund was derived from this source; and, at anything like the rate of increase here indicated, the farmer's profits would soon sink to zero, unless some counteracting influence were introduced.

Mr. Flatman, of Chippenham, Suffolk, who keeps very accurate accounts, has forwarded his figures for the 52 weeks ending March 25th, 1874, showing an expenditure for labour of 289*l.* 10*s.* 6*d.* on a bad light-land farm of 240 acres, all arable. Mr. Flatman hires steam-threshing machinery, but has included all the labour of threshing in this sum. He also includes malt for harvestmen, and beer during the year. Mr. Flatman's nominal rate of wages was 13*s.* weekly, but as a matter of fact his men earned, including harvest, 17*s.* 6*d.* per week. The labour expenses on this farm being 24*s.* 2*d.* per acre, seem so low, even for light-land cultivation, that whatever disadvantage is attached to a small farm as regards labour seems, in this case, fully compensated by what may be called concentrated personal supervision. In spite of the small cost of labour, I am told that, in proportion, as much corn is grown on this farm as on a larger one of similar quality.

Mr. Flatman's statement is a good illustration of the cost of light-land labour. Mr. D. K. Long, of Great Bradley, has given me his account of a large heavy-land farm; and Mr. Robert Stephenson, of Burwell, in Cambridgeshire, is good enough to supply me with particulars of his own farm as an example of a medium or mixed soil. In all three cases the same year, ending Lady-day, 1874 (just previous to the strike), has been taken. The same nominal rate of wages was paid in all three cases; and in each case the calculation is based on the same system, including all kinds of manual labour, with malt and beer, and the value of cottages, but only where they are rent-free.

Mr. Long's farm contains 130 acres of pasture and 800 of heavy arable land. As neither Mr. Long nor Mr. Stephenson ever cut any meadow-hay, they have charged all the labour to the arable land. Upon this basis Mr. Long's labour bill amounts to 38*s.* 6*d.* per acre, being a total of 1539*l.* on 800 acres of arable. Mr. Long ploughs and drains his land by steam, and thus, in his opinion, saves fully 6*s.* per acre in ploughmen's and horsekeepers

wages, which would have brought his labour, supposing he had no steam-plough, up to 44*s.* 6*d.*

The cost of labour on Mr. Stephenson's land is 36*s.* 3*d.* per acre on 864 acres of arable (384 light and 480 stronger soil). He also rents 162 acres of heath and 50 of pasture, not employing any appreciable amount of labour.

A neighbour of Mr. Long's, farming similar land, but doing no steam-ploughing, has sent me his account, which is accurately kept. He farms 10 acres grass and 277 arable land. Charging, as in the foregoing cases, all the labour to the arable land, it amounts, during the same period, to 43*s.* 6*d.* per acre, viz., 588*l.* 4*s.* 10*d.*; but the nominal rate of wages on this farm was only 11*s.* 6*d.* per week, and the men earned, in a rather short harvest, 8*l.* without beer. In order, therefore, to draw a fair comparison with Mr. Long's farm, 13 per cent. (the difference between 11*s.* 6*d.* and 13*s.*) should be added to the 588*l.* 4*s.* 10*d.*, which would make 663*l.* Thus, supposing an equal rate of wages, this calculation would show, upon the small heavy-land farm without steam-ploughing, an outlay of 48*s.* 7*d.* against 38*s.* 6*d.* upon the large heavy-land farm with steam-ploughing.

A comparison of the actual amounts paid on any farm for labour, during different years, cannot be wholly trusted to show, with accuracy, the tendency of the labour bill either to rise or fall, because the amount of work necessary on a farm varies from year to year according to the seasons or other causes. Comparing, however, the nominal rate of wages for the year ending Lady-day, 1874, with that of four or five years ago, the increase of 2*s.* a week, from 11*s.* to 13*s.*, paid throughout the greater part of the Eastern Counties, is equal to a rise of more than 18 per cent. Mr. Stephenson adds:—"I paid harvestmen, in 1873, 9*l.* 16*s.* and malt, in place of 7*l.* and malt in 1869, equal to a rise of 40 per cent. Working out these figures I find therefrom that, had I paid last year at the same rate as in 1868 and 1869, my labour bill would have amounted to 1186*l.* instead of 1453*l.*, showing a rise on the year's outlay of 22½ per cent. Then turning to my old labour books, I find, as a matter of fact, that my labour bill for the year ending Lady-day, 1874, stands 36 per cent. higher than the year ending Lady-day, 1869 (a year of drought), and 20 per cent. higher than that ending Lady-day, 1870. So my experience goes to show that there is no truth in the opinion so often expressed, that we can make up for the rise in wages by economising labour. Paying, as I do, about 270*l.* more for labour than I should have done 4 or 5 years since, means a deduction from a farmer's profits of from 2½ to 3 per cent. per annum on his capital. In some parishes the proportionate increase of wages is even more than in my case. In these places

the nominal rate was 10*s.* when mine was 11*s.*, while at this moment we all seem to be pretty firmly fixed at 13*s.* per week. Wheat has now fallen considerably in value without reducing wages, as was formerly the case; and I think in this neighbourhood the price of corn will never influence wages again. The high price of corn, lately prevalent, has hitherto prevented farmers from realising the effect of the extra cost of labour; but now, with wheat at 21*s.* per coomb, the case must be very different."

I have found it difficult to arrive at any satisfactory conclusion upon the comparative cost of labour on large and small farms per acre and relatively to production. The statistics already given do not deal with farms of very extended acreage. Indeed, it is not easy to define with accuracy what constitutes a large farm. For example, a farm of 500 acres would be reckoned small in Lincolnshire and large in Leicestershire. The general opinion expressed, in answer to many questions put to practical men, is that the cost per acre for manual and horse labour is less on large than on small farms. Here is one reply:—"A hundred acres of stiff arable land would be worked with 5 horses, while 140 acres would require only one more. Moreover, in all agricultural operations it is an enormous advantage to have a large and competent staff of men always at your call to execute work at the proper time. For these and other reasons the relative production is likely to be greater, and certainly the relative cost of production would be less on large than on small farms. But there are many exceptions in favour of small farms, where these are well managed."

Another farmer writes:—"However difficult it may be to reduce to actual figures the relative cost of labour on large and small farms, everyone who has had any practical experience in agriculture is well aware that the difference is very great. Within my own experience I have found that in the occupation of a farm of nearly 600 acres which had previously been held by two tenants, the saving in horse-labour was about 30 per cent., and in manual labour 20 per cent. This saving arose from greater concentration of force in the larger occupation which was wanting in the smaller one, and from a better supervision in the large, which would not be remunerative in the small occupation. There is no doubt also that the results obtained bore an exceedingly favourable comparison with regard to production, as was shown by the repeated enlargement of the rick-yards. On large holdings the labourers work in larger gangs, superintended by a working foreman. Thus the work progresses quickly, is soon finished, and something else is commenced before the men are tired by that particular kind of labour. Again, special men can

be retained and kept for special work, and thus become adepts at it, whereas upon small occupations a man has to do a variety of work and is perfect in none. The superior advantages of a large occupation, in respect of labour-saving appliances, are also shown in the description and character of the machinery employed. On a small occupation the use of machinery must necessarily be restricted, and many agricultural operations must thus be conducted on a small scale and by slow processes. The purchase and use of steam ploughs and drills would hardly be justified upon a small holding, whereas upon a large one these and many other costly implements are almost indispensable. They enable the occupiers to finish a large amount of work in a short time, without extraneous aid and at a moderate cost. The saving of time, in this way effected in farming, is of no small moment, especially in busy or 'catching' seasons."

For the purpose of any fair comparison between the cost of labour on large and small holdings, it is plain that you must not only compare land of the same quality, but land farmed upon the same system. "Speaking, generally," writes another farmer of great experience, "a larger staff of men per acre will be found upon large farms than upon small ones. A farmer occupying 200 acres will not be able to keep a steam-engine for his own use. It would require more hands for the profitable working of it than he would have at his command. It therefore answers his purpose better to hire an engine and men to do his threshing, chaff-cutting, and grinding his corn; whereas a large farmer can profitably employ for his own sole use a steam-engine for threshing, chaff-cutting, grinding, and, in some instances, for mincing food and cake-breaking. I believe the time will come when we shall have machinery for the various operations on the land, such as ploughing, &c., of a much more simple kind than exists at present. I have not hitherto seen a steam-engine used to save money—that is, by doing the work for less money than it will cost if I employ my own horses. It may be that, if you break up certain kinds of land by steam, you do good to the land and save money indirectly. But I want to see a direct saving of money from the use of steam-machinery, and believe that such a result must be exhibited before the use of such machines becomes general. Comparing the cost of labour upon large and small farms, I am inclined to think that it will be found less upon the former according to the value of the produce, though it may amount to as much per acre."

"The large farmer," writes another correspondent in the Eastern Counties, "has many advantages over the small one in the saving of labour. He can keep a better staff, and train men for certain kinds of work. By being kept to this work

they naturally become more expert, and in farming, as in pin-making, a proper division of labour produces the article at a lower cost." If so, good-bye to the handy man about a farm, invaluable to employers, who can plough, drill, hoe, thatch, stack, drain, clip hedges with an eye to form, and do pretty nearly anything. My last correspondent (Mr. Walton Burrell, jun., of Fornham St. Martin, Suffolk) considers the increase in the farmer's labour bill during the last few years to be from 20 to 25 per cent., without any corresponding increase in the value of produce, though there has been a considerable reduction in the rates. "The cost of labour," he adds, "on fair light land under the plough would not be much less than on heavy land, provided roots were grown on the light and not on the heavy land, and that both were farmed under the four-course system. Of course upon very poor light-land farms, where a large portion of the acreage is left as a sheep-walk, the labour bill would be small. If an equal quantity of roots were grown on the heavy land instead of clean fallow, the proportion would be about 3 on the light to 4 on the heavy land. As to the influence of machinery upon the cost of manual labour, I question whether in many instances work is not done as cheaply by manual labour, provided only that men can be obtained in sufficient numbers when they are wanted. But the day has happily gone by when the farmer could find half a score of men on the village-green waiting for a job, to be set on, and paid off, at his convenience."

"Nearly one-half less horse-power," say the writers of another letter, farmers in the Midland Counties, "is required to work light land. But although the work on light land may be done with much less toil than on heavy land, there is not so much less manual labour as at first sight there seems to be; for a crop of turnips and the eating and superintending of a large flock of sheep is a very costly method of producing meat in these days of high wages. If a light-land farm is well managed, it will require nearly as many men as a heavy farm. A great deal of work on the latter arises from the fact that every article grown upon it must be taken into yards to be eaten, and then, after a time, must be carted back to the land, in the shape of manure. All this creates much wear and tear."

As to the comparative cost of labour on grass and arable land, a letter from another farmer in the Midland district is to this effect:—"On grass land the cost of labour is reduced to a minimum. A man and strong lad can attend to the flocks and herds on 500 acres of grass land during the summer months. On the same quantity of arable land, at least eight men besides lads would be required, to say nothing of horses and implements.

On grass land the cost of labour is very small, but the capital required is much larger per acre, and greater supervision is necessary on the part of the occupier." Another correspondent reckons that the cost of labour on grass land would be about a fourth of that on arable land, supposing half the grass were cut, and half fed off.

"Of course the saving in labour upon grass lands," writes another farmer, "must be all the labour in ploughing, cultivating, seeding, &c.; and, where they are grazed, the cost of harvesting is also saved. The same calculation, however, must not be made with regard to all grass fields which may be attached to an arable farm. Upon such a farm a certain staff of horses and men will be required all the year round. If, therefore, the farmer in this case loses the opportunity of making the most of a piece of pasture by mowing it instead of grazing it, he will lose money, because his outgoings will be the same in labour whether he mows the field or grazes it. Upon a purely grass farm, on the other hand, manual labour is only necessary at hay harvest, when the occupier can avail himself of itinerant labour from neighbouring counties. To the grass farms around London, for example, men used to resort in June from all parts, sometimes obtaining high wages for a week or two. Mowing machines, however, with horse-rakes and haymakers, have supplanted much of this manual labour, enabling the farmer to secure his crop more quickly, and also more cheaply, without feeling so dependent upon casual hand-labour as he once was. From this neighbourhood (the border-land of Norfolk and Suffolk) during the last two years many men went 'into the shires' as usual, but could have done better by remaining at home. It is highly necessary now-a-days for each farmer to calculate carefully whether he has a prospect, by grazing, of making a profit over rental and fixed charges per acre, instead of incurring a great outlay in labour, with the chance of a wet season, and a plentiful crop elsewhere, to reduce the value of his hay harvest, so that the balance of profit left after mowing is less than that left after grazing. To stock good grass land naturally requires the command of more capital than is necessary for the cultivation of arable land. I have heard of *30l.* an acre being required to purchase stock for good marsh land. Some marshes will carry a bullock and two or three sheep an acre. The grazing of light land, instead of tillage, would of course be for sheep-feed only, unless I may except sainfoin, which is the salvation of light lands, and ought to enter into the rotation of every light-land farm."

It may be taken for granted that farmers in the Eastern Counties are not alone in their experiences of the increased cost of labour

and the inroad thus made upon profits. I will give, however, some figures bearing on the same point, supplied to me from three farms in the Midland Counties, well-managed mixed farms, fair representatives, I believe, of a very large class of holdings. No. 3 has not been occupied by the present tenant for so long a period as the two others, and, therefore, his figures cover a shorter space of time, though they refer, like the rest, to three years of farming, and tell the same tale :—

	Year.		Cost of Manual Labour. £	s.	d.
No. 1.	1862	Farm of 340 acres (130 plough, 210 grass)	280	5	0
	1868	Do. ,, ,, ,,	373	6	0
	1874	Do. 388 ,, ,, 258 ,,	419	16	0
No. 2.	1862	Farm of 210 acres (80 arable, 130 grass)..	223	10	0
	1868	Do. ,, ,, ,,	249	19	0
	1874	Do. ,, ,, ,,	272	0	0
No. 3.	1869	Farm of 230 acres (120 arable, 110 grass)	268	16	0
	1872	Do. ,, ,, ,,	307	14	0
	1874	Do. ,, ,, ,,	344	12	0

The expenditure for manual labour, set forth here, does not include the value of beer; and every man employed on these farms has a quart a day during nine months of the year, and two quarts a day during the remaining three months, in the course of haying, harvest, and other exceptional work. Nor does the foregoing account include tradesmen's bills, such as blacksmith's and carpenter's work, which may be put at 7*s.* an acre. My correspondent says :—" Wages have risen here from 30 to 40 per cent. (at the lowest estimate 30 per cent.) within a comparatively short period. In 1862 a good able-bodied labourer would earn 12*s.* a week, besides beer and other perquisites, and he received these wages wet or dry, whether he could work or not. In 1874 we pay 15*s.*, 16*s.*, and 17*s.*, with all the same perquisites; and in many cases a cottage and half a rood of ground rent-free into the bargain, worth to rent 2*s.* 6*d.* to 3*s.* a week. This, however, is not all. Notwithstanding the extra cost of labour, we do not get above two-thirds of the work which used to be done, and there is a discontented murmuring, which is worse than all. Boys fit to drive the plough formerly received 2*s.* and 2*s.* 6*d.* a week. This year they will be a scarce article until they are old enough, or have learning enough, to leave school under the Education Act. A lad, 11 years old, is now getting 6*s.* a week; if 14 or 15 years old, 9*s.* a week; if 17 years old, 12*s.*"

Another Midland County farmer says the rise in farm wages "may be roughly stated to be at the rate of 30 per cent., without any improved standard or quantity of work done, but rather the

reverse. As a matter of course this increase tells adversely upon the occupier, diminishing his profits, and, as any reduction of rent is improbable, placing him in a very awkward dilemma. The use of machinery and the progress in agriculture of late years have given a fillip to wages. The more frequent use of steam has developed the intelligence of the labourers, some of whom must manage the steam-machinery. The various local agricultural Societies have also done their best to encourage latent talent among the men. The result is that, while the condition of the mass of labourers has improved, such of them as possess any exceptional skill have often benefited still more. This is as it should be." Then my correspondent shows how the recent agitation in the labour market has acted upon supply and demand; but into these moot questions we need not follow him.

If from the Eastern and the Midland Counties we take a short flight to Scotland, we find the labour bill there apparently increasing quite as rapidly as in England. The following notes are kindly furnished to me by an Aberdeenshire gentleman practically acquainted with the farming of that district:—

"The average cost of farm-labour in Aberdeenshire (I use this word, though it may be held to include good part of three or four neighbouring counties) has nearly doubled within about a quarter of a century. The ordinary mode of engagement is to provide the labourer with board and bed, and pay half-yearly wage. Thus:—

		Wages in 1840, per 6 months.							Wages in 1874, per 6 months.						
		£	s.	d.		£	s.	d.		£	s.	d.		£	s.	d.
1st ploughman ..	from	7	10	0	to	8	0	0	from	13	0	0	to	15	0	0
2nd ditto ..	,,	6	0	0	,,	7	0	0	,,	11	10	0	,,	14	0	0
Cattlemen	,,	6	0	0	,,	7	10	0	,,	13	0	0	,,	15	0	0
Female workers ..	,,	2	10	0	,,	3	0	0	,,	5	0	0	,,	6	0	0

"It is *not* the large increase of wages our Northern farmers complain of; it is that the men who are most capable and efficient go off through emigration, and otherwise seek to benefit themselves, in such large proportion, leaving only the less capable and less enterprising at home. For example, a large farmer and well-known breeder of Shorthorns complained to me the other day that, while perfectly willing to pay wages for competent ploughmen at the rates stated (practically 30*l.* a year, with bed and board), his overseer had been compelled to fill up his staff largely with half-grown lads, experienced ploughmen being so scarce.

"In the working of an Aberdeenshire farm of medium or large size, one ploughman, with a pair of horses for every 60 to 80 acres, is deemed sufficient. On very small farms 50 acres require

a pair of horses; but usually the horses are not so powerful in that case.

"A thoroughly efficient Aberdeenshire ploughman, with his two horses and swing-plough, will, I should imagine, till a greater extent of land, and in a more satisfactory style, than any other team of equal power extant; that is, a single man (paid at a comparatively high wage) and two good horses will be found cheaper far than any of the miserable devices that exist in some parts of England with underpaid labourers, one driving the team, another holding the stilts of the plough, and so on. The cost of a ploughman and pair of horses per day, doing hired work, is 9*s.* and 10*s.* Steam-cultivation is not yet so far introduced as to have sensibly affected the cost of horse-labour; but it will be and is being heartily welcomed by all intelligent farmers as an aid to deeper and more thorough cultivation—on the principle that for an increased outlay they will reap a larger return.

"A point worth noting in our farming is the very large expenditure systematically made for extraneous manures,—bone-dust, guano, phosphates, &c. A trustworthy estimate is that the average expenditure yearly for such manure in Aberdeenshire is equal to from a third to a half of the entire rental of the county."

A Forfarshire tenant, on a friend's estate in that county, gives me the benefit of his experiences upon the cost of labour on a farm of 300 acres, with an average production from grain-crops of five quarters an acre. This is the farmer's mode of showing the outlay for manual labour:—"Divide the 300 acres into six parts, three of them in grass, to be pastured with either sheep or cattle. Then:

	£	*s.*	*d.*
1–3. Labour, outlay in looking after stock and keeping up fences on 3 acres of pasture, at 6*s.*...	0	18	0
4. An acre of oats, labour, outlay in ploughing, harrowing, sowing, cutting, and carting	2	2	0
5. An acre of turnips and potatoes. Crop, 20 tons of turnips per acre and 7 tons potatoes. Cost to plough, harrow, grub, clear the land of weeds, sow, thin the turnips, &c.; plant and dig potatoes. Total expense of working per acre	3	11	6
6. An acre of barley—manual labour upon	2	2	0
Total cost of working 6 acres of the above farm ..	£8	13	6

Upon this basis of calculation the total labour bill would amount to 433*l.* 15*s.* upon the 300 acres, and would work out to 1*l.* 8*s.* 11*d.* per acre—a low average contrasted with this item of expenditure in some of the English farming-accounts already given, and especially low if the crops here mentioned represent a

fair average, and if the same ratio of production is generally maintained. The secret of the low labour bill here lies chiefly, no doubt, in the large proportion of land in grass, viz., one-half, instead of one-fourth or one-fifth as in the south-eastern counties of England. In Forfarshire, as in Aberdeenshire, the wages of agricultural labourers have risen rapidly. The farmer draws the following pithy contrast between the cost of labour now and formerly:—

30 years ago the money wages were	£12 a year.
20 " " "	18 "
4 " " "	24 "
At present the money wages are	34 "

The men, he adds, are generally engaged by the year; but sometimes are engaged by the half-year. The payments in kind consist of an allowance of 2 pecks of meal per week, 1 pint of new milk a day, with fire and light in the "bothy."

	s.	*d.*
The meal, milk, and bothy accommodation are valued at, per week,	6	6
Present money wages	13	0
Total weekly wages of Scotch able-bodied labourer	19	6

"Tradesmen's accounts upon the farm," adds this Forfarshire tenant, "have risen much in the same proportion as farm labour. So have taxes. Against these items of increased expenditure we may set the fact that we have been able to do with fewer hands, owing to the introduction of machinery, improved steadings, and drainage of land. Thus we have been able to balance income against extra expenditure. Twenty years ago, upon the farm of 300 acres just mentioned, there would have been employed six men, two boys, and three women, for the regular work; whereas we now keep four men, two boys, and one woman. The saving of labour is more especially felt during harvest, when, at one time, 50 hands would have been employed, whereas now not more than sixteen in all are employed. To sum up the whole, wages have risen one-third, and production has increased in about the same proportion. The farm-labourer's position will improve still further, if emigration continues and trade prospers."

This letter suggests several considerations bearing materially upon the English view of the labour question. In the first place, we see long hirings to be the rule; whereas in England they are the exception, and usually apply only to shepherds and some of the stockmen. The Labourers' Unions are said to oppose long hirings. As far as I know, they have passed no rule either for or against them; and if the wages are made worth a man's while, depend upon it he will engage upon these terms, whether the Unions favour long hirings or not. My observation leads me to

the conclusion that the chief prejudice against long hirings lies with employers. "Farmers in this neighbourhood," writes a Cambridgeshire farmer, "are not inclined to hire men for a length of time with a view to prevent the inconvenience of strikes. On the contrary, the feeling is that, if a discontented man were bound for a term, he would work so unsatisfactorily that a farmer would be glad to be rid of him at any price." But why should it be assumed that men would be discontented if they entered into such engagements with their eyes open? And why should a mode of hiring almost universal in Scotland and the North of England be impracticable or unsatisfactory in the South, where long hirings, as we have seen, do in fact prevail partially at present? If the northern practice became general, it would have more than one useful result. The tie between master and man would become closer, and labourers would be less liable to estrangement from employers at the instance of strangers. The labourers would also feel a certainty of steady employment. Their wages would be paid in regular weekly sums, instead of being brought up to a respectable average of cash payments by high wages during a single month of the year. On the other hand, employers would be relieved from the fear of being left without labour at seed-time or harvest, or other critical periods; and they would know what their labour bill would be during the year, instead of feeling that they were exposed, at a week's notice, to demands from their labourers which might upset all their calculations of profit, and would have materially altered their course of cultivation had they foreseen such demands.

Again, in reading this Forfarshire letter, one cannot avoid the impression that, if the Scotch hind works harder than the Southern labourer—a fact which seems to be generally admitted—the Southern farmers have not secured from the introduction of machinery the same saving in manual labour which has been effected by farmers across the Tweed. The smallness of the regular staff of labourers upon this and other Scotch farms of which one hears, compared with the staff maintained upon English farms of equal acreage, may be in part explained by the greater energy thrown into the work of the Scotch peasantry, and this may be an affair of thew and sinew and race. Is it not, however, also due in no small degree to stricter supervision by the Northman, a rigorous resolve to have money's worth for money, care in noting when labour has been rendered superfluous by machinery, and the maintenance of the smallest possible establishment for ordinary farm-work, supplemented by unskilled labour on extraordinary occasions? One would make this suggestion with greater hesi-

tation but for the fact proclaimed by farmers in every part of the Eastern Counties during the strikes and lock-out of 1874, that they were able to dispense with much labour which they had hitherto been accustomed to regard as indispensable. It seemed to be regarded as a new revelation; but I suspect that circumstances forced upon the Eastern Counties farmers a discovery which Scotchmen made for themselves long ago. No doubt, the ease with which most employers in the Eastern Counties tided over their difficulty last year was due in a great measure to the singular dryness of the season. Making every allowance, however, for this cause, I think the lesson of 1874 will have been learnt in vain if it does not teach English farmers everywhere to economise production by reducing establishment charges. Nor does an economy in this direction mean hard measure to the labourer, but the very reverse. It is not the interest of the tillers of the soil that superfluous labour should be employed. Wherever that state of things exists, wages must necessarily be low, and the labour given in return for wages will generally be dear labour.

A recent speech, by Mr. C. S. Read, M.P., has directed the attention of farmers anew to the points last mentioned, which cannot be too often impressed upon all employers. In addressing an Agricultural Association in Norfolk, Mr. Read said he found that the average weekly pay of a common day labourer in Norfolk was about 17*s.* 6*d.*, whereas in Northumberland and Scotland he was assured that it came to nearly 25*s.*, and he added:—

"Mr. Barclay, the Member for Forfarshire, is, like me, a tenant-farmer . . . He farms 380 acres of arable land, which is exactly the acreage of land I have at Honingham. He has 75 acres of rough pasture, and I have 40 acres of good permanent grass. He grows 20 acres more corn than I do; but he has less roots and more grass seeds than I have. Taking the cold, damp Northern climate into consideration, I should say he would require as much manual labour on his farm as I do on mine. But mark the difference. For the four years ending 1871 the average annual payment for labour (two-thirds in cash and one-third in milk, meal, and potatoes, &c.) was 400*l.*; while mine was 750*l.* In 1872 and 1873, Mr. Barclay's had risen to 510*l*; but, as he puts 30*l.* of it down to extraordinary labour, he considers the real increase to be only 20 per cent. Now take my expenditure for those years, which, being about 850*l.* and 750*l.*, would average 800*l.*, and you must surely admit—that which I knew long ago—that the Scotchman is a sharper and keener man of business than I am; and I also come reluctantly to the conclusion that the highly-paid Scotch hind is a cheaper

and better man than the Norfolk labourer, and that, after all, there is no such thing as cheap labour." *

We have not the details which would enable us to generalise with entire safety from these figures. But the moral drawn by Mr. Read is, no doubt, in the main a just one; and it points to the conclusions I have already suggested—that two elements contribute to the smaller labour bill in Scotch farming: a better quality of labour, and keener supervision and regulation of it by the farmer. Between the 25*s.*, of which Mr. Read speaks from hearsay, and the 19*s.* 6*d.* which my Forfarshire correspondent actually pays, there is a wide difference. I have no reason to doubt that 19*s.* 6*d.* is the market rate paid in the latter county; and as it agrees substantially, in respect of money wages, with the report I have received from Aberdeenshire, the most probable cause of the discrepancy lies in the different appraisement of the bothy accommodation and the doles of food, the latter of which may easily vary in different districts.

It may be that 19*s.* 6*d.* in cash and kind is a lower average of wages than exists in other parts of Scotland. If we include the perquisites, harvest money, extra earnings in piece-work, and under-rented cottage and garden of the Eastern Counties labourer, I doubt whether the latter is not often better off than the Scotch hind upon such wages. Comparing the better class of cottages here with the bothy accommodation provided for the Scotch peasant, the Eastern Counties labourer will certainly have a more comfortable home. If wages, therefore, are substantially equal, there ought, in theory, to be no great disparity in the amount of work done by the Forfarshire and the Suffolk peasant. Farmers, however, seem to be quite agreed that there is a great disparity, and one unfavourable to the Southern labourer; and complaints on this score are too general to allow of any doubt that they are well founded. But, if this be so, one must surely look for the same marked superiority in Scotch operatives and industrial workers of all classes. No such evidence, however, is forthcoming. I have said that a distinguishing feature of agriculture is a happy absence of competition, so that there is no reason why "two of a trade"—or why any number of the farming trade—should not agree. If the same keen competition existed in agriculture as in manufactures, we should long ago have heard English farmers complain how heavily they were weighted in this respect, compared with their Northern rivals. There is a keen rivalry in many kinds of manufacture between North and South Britain, yet we do not find that Scotch manu-

* 'The Times,' October 17th, 1874.

facturers are monopolising production through their command of a superior quality of labour—nominally dearer, but really cheaper than that obtainable on this side of the Tweed.

If, therefore, English manufacturers hold their own, employing English workmen, is it not possible for English farmers also, with the materials they have, to do so too, and obtain, in agriculture, results as economical and as satisfactory as are obtained in manufactures? One does not willingly assume that the English agricultural labourer is so different a being from the English artisan in energy, stamina, and the will to work, that while one can hold his own against the same class in Scotland, the other is hopelessly beaten. At all events it is time, for their own sake, that employers tried to bring the English labourer to put forth his full strength, or more of it than he puts forth now. I cannot help thinking that there is, among the mass of our English peasantry, a great reserve of power waiting to be called out, and ready for use if adequate inducements are offered. We see what happens if a man gets a bit of land. He bestows upon it an amount of labour often wholly out of proportion to the produce of the land—labour which would have yielded him twice or more than twice the money-produce of the land if he had worked with the same energy and during the same hours for a farmer. The reason is that he has an adequate motive for work, or thinks he has, which comes to the same thing. Now, can employers present to him the same adequate motive in another form, and lead him to serve his own interest and theirs by working not necessarily longer hours, but by working harder while he does work?

This is a problem of the first importance. It is hardly inferior to that of increasing production by higher farming. In fact, it is one method of stimulating production and increasing national wealth very largely by adding to our labour-force, without at the same time adding to the number of mouths to be fed. The system of day-labour may answer in Scotland. It does not follow that in England another system may not be adopted with success. Nor is it of any use to say that English labourers in the Southern and Midland Counties ought to work by the day as well as those in the Northern Counties and in Scotland. The general answer is that they do not. From different parts of England the same complaints reach me, that farm-labourers do not do anything like a full or fair day's work in the day.* The

* I have myself heard a Northumbrian farmer declare that one of the strong, big-boned women, who worked in his fields, was worth much more than any average Southern labourer. An East Suffolk farmer writes to me to the same effect. "I protest," he says, "that one of the Scotchmen whom I formerly employed would do as much work as two and even three Suffolk labourers. It

Eastern Counties farmers who set their hands to the plough or drill, when lately deserted by their men, found that in the same hours they could do half as much again as their men got through, and without over-fatiguing themselves. What reasonable stimulus, just both to employers and labourers, can be offered to the latter to do what they could surely do, if they liked, with much less effort than employers unused to exhausting labour, and many of them, like Hamlet, "fat and scant of breath"?

2. I do not think this problem insoluble, and piece-work seems to be the best way out of the difficulty. Piece-work is a protection to the farmer, who then pays only for work actually done. It affords also the strongest inducement to the labourer to put forth his full energies. The system is not without difficulty in its application. Upon almost every farm it will require some amount of special adaptation and management. The soil, the seasons, the implements, the course of husbandry, all require careful study. Above all, the farmer must not be niggardly in the rates he fixes. The attempt to introduce piece-work will be sure to break down if employers attempt to take the lion's share of whatever surplus exists over and above an average day's work. Given an average day's work, and the usual pay for it, then the extra work done, measured by the same standard of pay, would yield a fund, of which two-thirds might fairly go to the labourer, and one-third to the employer for his trouble in planning and laying out the work, and for capital invested. It is of no use to conceal the fact that the adjustment of a fair tariff to meet the varying conditions of different farms in different districts would involve much trouble, and more personal supervision than is frequently given by farmers. But it is a farmer's business to take trouble in what concerns the cultivation of his farm; and there is no task to which he might devote himself with greater advantage to his labourers, to himself, and to the State, than that of endeavouring to apply this piece-work system to his own holding.

The system is not new or untried. It has long been practised in some departments of farm-work by men of practical experience in various parts of England. Elsewhere I have described the working of the system upon a light-land farm of about 800 acres rented by Mr. W. Mathew, of Knettishall, near Thetford;* and the main facts may, I think, with advantage be

makes one's flesh creep to see some of our men at work. Many appear to be anxious to do as little as possible when the eye of the master or the bailiff is off them."

* Mr. Herbert J. Little, in a paper read before the Farmers' Club, on "The

reproduced here, if only to show that the plan now recommended is not a mere theoretical one, incapable of practical application. We may begin with harvesting, which upon the Knettishall Farm differs somewhat from similar work upon most other farms in the system of remuneration to the men. Elsewhere in the Eastern Counties the farmer generally treats separately with each labourer, who receives so much money for harvest, according to whether he is a "full man" or a "three-quarter man," irrespective of the time occupied by the work. At Knettishall the farmer contracts not with each labourer separately, but with the whole body of labourers, to whom a stipulated sum is paid, and the companionship then divide this money among themselves, not in equal proportions, but according to their own notions—generally pretty accurate—of what each has earned. The agreement is to this effect:—"Agreed for the sum of 170*l.*, with the men whose names are herein written, to do all the harvesting of the corn in a proper and husbandlike manner, to include the thatching of the same, and also the seeing after the horses, cows, and pigs, littering the yards when necessary, carting straw for thatching, and any other work incidental to the securing the corn and attending to the stock. There being 32 acres of corn more than last year, it is further agreed that a sum per acre equal to the payment of 170*l.* for the same quantity of acres as was done last year shall be paid in excess of the above sum of 170*l.*"

The names follow this simple form of contract, which answers its purpose in being easily understood, and in binding both the farmer and his men. The acreage of corn covered by this agreement was—wheat, 114; barley, 138; oats, 38; rye, 32. Before the corn-harvest, 34 acres of peas were cut by hand, and cost 7*s.* 6*d.* an acre, which included cutting, carting, stacking, and thatching. Twenty acres of sainfoin and 10 acres of clover were cut with the machine, and cost 4*s.* an acre. The corn-harvest worked out at about 12*s.* an acre, including everything. No difficulty or dispute arose among the men in the division of the lump sum earned by them. They know better than any-

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Future of Farming," refers to the letters of the special correspondent of 'The Times,' for the example of "a Suffolk farmer who has led the way in introducing piece-work into almost every department of his business." Mr. Little strongly advocates the general adoption of this system, and gives the following instance of wasteful labour "which must have occurred to anyone having the management of a farm. It is a matter of the simplest calculation that a pair of horses, walking at the rate of two miles an hour, and ploughing a 9-inch furrow, will, in $5\frac{1}{2}$ hours, accomplish an acre. Add to this the necessary time for turning at end, and going to and from work, and it will seem a matter of surprise that, unless closely watched, the ordinary ploughman will scarcely perform his acre of average soil in an eight-hours' bout." Here not only the man's but the horses' time is wasted under the day-work system.

one else can know the value of each other's work. It is, in fact, co-operative farm-labour. The same principle has been tried with equal success in building the Workmen's Homes upon the Shaftesbury Estate near Clapham Common, where co-operative labour is said to have saved 20 per cent.; the result being not only cheaper labour, but labour of much better quality than that employed under contractors.

The republican plan in vogue at Knettishall worked admirably. As I have said, it was not based upon any arbitrary or fictitious notion of perfect equality among the harvest-men, and a claim by each adult to an equal share of the money earned. A curious commentary upon the doctrine to this effect, taught by a good many labour associations, or tacitly enforced by them, is furnished by the fact that, in this and other instances, where the men are themselves brought face to face with this principle of "natural equality," they repudiate it altogether. They go then upon the much more obvious and reasonable principle that, as the labourer works, so shall he earn. They do not, indeed, in the harvest-field resort to any standard of measurement. Given an able-bodied man who can keep his "stroke" among his fellows in the harvest-field, and does not fall out of the ranks through weakness or idleness, and he receives a full share according to the highest standard. But equity requires that any man who comes short of this standard shall abate his claim proportionately. Thus an able-bodied man, whose nominal weekly wages during the year were 14*s.*, received 8*l.* 19*s.* for his harvest-earnings; and the shares of the three-quarter men, half-men, and boys, were based upon this sum. Even the boys form part of this commonwealth of labour, and it becomes the obvious interest of the men not only to look sharply after them, but after each other. One of the virtues of such a system, however, is the spirit of emulation it produces among all the harvest-workers. The gang-master, or his deputy, or the "boss," as he would be called across the Atlantic, is not wanted to keep the men going. As a rule, they keep each other going, and the feeling soon becomes general among them that loitering and slack work are against the common good—an offence not against the master, which might be venial in the eyes of the workers, but an offence against each other, which stands on quite a different footing. It should be added that, under this contract, the men receive all their earnings in cash, and nothing in kind. Not long ago, upon the border-land of Norfolk and Suffolk, the harvest-wages were 5*l.* 10*s.* for an adult labourer, with two bushels of malt, and a proportionate quantity of hops. The men in this instance find their own malt and hops, if they want any.

At Knettishall ploughing is paid for at the rate of 1*s.* 4*d.* per acre. As Knettishall is a light-land farm, two acres are generally finished off in a day with a double plough, without hurting either men or horses. On heavy land a different rate of pay would of course be necessary, and there the farmer must take care that in ploughing by piecework the strength of the horses is not overtaxed. Upon a heavy-land farm a man might not be able to do more than half an acre a day, and this day's work might try the horses more than two acres upon light soil. Another scale would be necessary upon mixed-soil farms, and upon the same farm difference of soil might require two different scales of remuneration. There would be no greater difficulty, however, in providing for these cases than has been experienced here, where for two years past the system has been found a fair one both to master and men. An obvious objection to it is, that the work may be hard or easy, according to the season, and that a price which is just at one time may be inadequate or excessive at another. Mr. Mathew gets over the difficulty by putting out the ploughing at a fixed average price, taking one season with another. After a little experience, and with a mutual wish to give and take on both sides, such an adjustment of pay is not hard to make. The conditions of this work are so various and so complicated, that no general rule can apply. On either side of a hedge the soil may be such as to require different pay for the men employed in ploughing it. Average rates would probably be the best in such cases, having regard to the soil upon the farm generally. Here it is found that, with 1*s.* 4*d.* an acre all round, the men earn an average of about 4*d.* a day above the rate of daily wages. The practice is for the men on piece-work to draw money from week to week from their employer to the amount of weekly wage they would receive if paid at the current wage-rate. An account of their earnings is kept meanwhile. If they want a little money on account they can have it. At the end of two or three months a balance is struck, and they receive whatever surplus is found due to them.

For mowing the men receive 10*d.* an acre, the farmer, of course, finding machines and horses. After the mowing is ended, day-work begins till the hay is fit for carrying. Piece-work is hardly possible then on account of the weather, for in fickle weather the work must sometimes be done over and over again. Pitching and loading are done by the piece. Sixpence is paid for a 2-horse waggon-load, which would be nearly equal in the loose state to a ton of hay in the truss. A good day's work would be 32 loads, and this would be the work of four men, two to pitch and two to load. At 6*d.* a load these four men would earn 16*s.*, or 4*s.* a day apiece, and they are allowed two pints of beer. Unloading on

to the stack is done by four men in the same way, and is paid for at the same rate, the farmer finding a man to stack the hay. Of the four men, one would be on the waggon and three on the stack.

Hoeing is also done by the piece, but on a different principle. The custom around Harling is to let the work to a gang-master. The whole of the hoeing at Knettishall, upon 127 acres of wheat, has been taken this way at *2s. 10d.* per acre. A large proportion in Norfolk is also hoed by contract, as well as some other farm-work, such as "mucking" and getting up mangolds and swedes; and it is thought that the gang-system will make progress in Suffolk, as it enables farmers to dispense with some regular hands and to save time in hoeing, while the work is also more cheaply and on the whole better done. In the gang employed at Knettishall about 20 men and boys were employed, the men earning about *2d.* a day more than if they were working as ordinary farm hands. The gang-master or his deputy looks sharply after the men to keep up the "stroke," and prevent idling. Somehow the farmer cannot get the same "stroke" or rapid work from his men, even when the hoeing is done by the piece, probably because the men in the gang are picked, experienced hands. The gang-master makes money. He finds a horse and van to take the people to and from their work, and can provide employment for them pretty nearly all the year round. What with this certainty of employment and high wages he has never any trouble in getting men, and good men; and there is constant emulation among the younger ones to work quickly and well, because they know they will earn more money as soon as they can keep up in their stroke with the leading men. The supervision of the gang-master or his deputy is chiefly in the quality of the work, for as to quickness the men need little urging. They are jeered at if they lag behind, and they do not like to get a character for being slower than their neighbours. Indeed they would be very soon turned out of the gang if the gang-master or his sharp foreman saw they were reducing his profits and not giving money's worth.

Sanfoin, a favourite crop at Knettishall, used to cost for mowing *5s.* an acre, yielding about three tons an acre. It now costs for mowing with the machine *10d.* an acre. This is one economy effected by machinery which has helped the farmer in the hay-harvest more, perhaps, than in any other kind of labour. Here the hay is now put on the stack at the same price per ton as it used to cost for mowing. While the regular wheat-hoeing is done by gangs, such other hoeing as remains is left for odd jobs, and is either done as day-work or with the horse-hoe at *3d.* an acre. The turnip-hoeing is done chiefly by old men who are not equal to harvest-work. For swedes and white turnips the

rate is 7*s.* 6*d.* an acre. Mangolds cost 8*s.* "Mucking" is paid for at per score loads. Filling muck into "tumbrils" (Suffolk vernacular for heavy two-wheeled carts) and spreading on the land costs 6*s.* a score loads, a tumbril holding about 40 bushels. The 6*s.* is thus divided: for filling, 2*s.* 6*d.*; spreading, 2*s.* 6*d.*; the boy who leads receives 1*s.* At this work a man may earn 2*s.* 6*d.* a day. Fencing and ditching are paid for by the rod. Dressing corn is paid for by the 20 coombs, and costs 1*s.* per score for each time of passing through the dressing-machine. Threshing is done by the farmer's machine, and is not paid for by the piece. The men who drive the engine and attend to the drum receive 1*s.* a day extra; the man who attends to the sacking of the corn 6*d.* a day extra. All the other men who have anything to do with the engine-work get 2*d.* a day extra; and a pint of beer a day all round encourages them to get through the work quickly. Sowing artificial manure is paid at the rate of 3*d.* a day extra upon the nominal wages of 14*s.* weekly. Overtime is paid for in cash, and not by bribes of beer—an excellent innovation upon a bad system. The regular hours in summer are from 6 to 6, with half an hour for breakfast and an hour for dinner. By paying 3*d.* an hour for overtime the employer can command the services of the men when he wants them. They are ready enough to add a little to their earnings in this way, and cease to feel that they are "doing a lot for nothing."

Sheep-clipping is another part of the piece-work system at Knettishall, but the same system is common to most of the farmers in this district. There are gangs of clippers who travel about the country at shearing time, and are noted for their expertness, and also for their drinking powers. The farmer allowed them, nominally, a quart of beer for every score of sheep, and, as there were 36 score, they were entitled to 36 quarts. In fact, they received 10 gallons. But this allowance by no means met the wants of such thirsty souls, and they ordered nearly 15 more gallons from the nearest public-house, of course paying for it themselves. Sheep-shearers, however, seem to have shared in the gradual improvement of their class, though a good deal of room is left for improvement still. Even 25 gallons drunk in a single day by 21 men, is a much smaller quantity than used to be consumed by the sheep-shearers when the beer was supplied without limit by farmers for whom they were working. "In my father's time, 30 years ago," said the farmer, "nearly double the quantity would have been consumed." The work, it is true, is hard, and the clippers put forth all their strength in getting through it rapidly, immediately moving off to the next job. The contract with them is to clip the ewes at 3*s.* 6*d.* a score, hoggets at 4*s.* The winding up of each fleece before it is packed

away costs about 10*s.* upon 36 score of sheep, and the whole work would be cleared off in a day by the gang. I believe it is not easy to join this companionship. An entrance fee is demanded from new-comers, and the leading man of the gang is particular in admitting only strong, healthy recruits. A vacancy rarely arises except through death or old age, for the employment is lucrative and congenial to men not afraid of hard work and liking the excitement of moving about from parish to parish. As to lodging, the clippers sleep in a barn, under a stack, "or anywhere," while they go about the country. They make nearly 10*s.* a day apiece—at least the best hands do, for here again a man must approve himself by quick and good shearing before he can expect a full share of the money earned, and at first he will probably only receive a quarter of the sum shared by the others. Really good clipping is a difficult handicraft, and the immense experience of these gangs makes them much sought after by the farmers.

For drilling wheat, 6*d.* an acre is paid. In drilling soft corn—barley, oats, peas—the land can be got over somewhat more quickly, and the price is 5*d.* an acre. The men get through 10 acres of wheat and 10½ or 11 of soft corn daily. If the average work is 10 acres of wheat, the men will earn 1*s.* a day above the rate of day wages, or rather more than 1*s.* Something, of course, depends on the horses as well as on the men. Eleven acres and a half have been done in a day. I am assured it is not very hard work: but to make up such a daily average there must be "no stopping at the ends;" you must "keep going on." Here is an account of 23½ days' work in drilling:—Soft corn, 210 acres (some on mixed, some on light soil), at 5*d.* per acre, 4*l.* 7*s.* 6*d.* Seeds, 14 acres, 5*s.* 10*d.* Sainfoin, 21 acres, at 3*d.* (a long, wide drill is used, covering a good deal of ground), 5*s.* 3*d.*; total, 4*l.* 18*s.* 7*d.* Deduct money paid on account, 2*l.* 9*s.* Balance earned in excess of nominal weekly wages, 2*l.* 9*s.* 7*d.*, divided between the man who leads the horses and the man behind who holds the drill. These extra earnings are a great encouragement to both men, and the money thus made in drilling is said to be equivalent to an extra shilling a week upon their wages all the year round. The total acreage covered by them in these 23½ days' work was 245 acres, which gives a daily average of very nearly 10½ acres. There are plenty of farms on which no more than six acres a day are got through. A difference in the width of the drill may account in some measure for the smaller acreage covered, but probably a cause which has greater influence is the different mode of payment and the stimulus which piece-work gives. Both the men engaged in the drilling at Knettishall were horsekeepers receiving 15*s.* a week,

1*s.* above the ordinary wages, and they paid no rent for their cottages, which have two rooms downstairs and three bedrooms. The shepherds also live rent-free.

Vipers and rats seem an unlikely source of income, but they add a trifle to the wages at Knettishall, and I dare say at most other farms where these vermin abound. Here again the payment is by results. Rats are worth a penny each to the man who can kill them; vipers twopence. It costs the farmer 8*l.* or 10*l.* a year to keep down the rats at Knettishall. An unusual number of vipers made their appearance during the hot, dry season of 1874, and a boy caught eight in one day. They are not pleasant visitors, for they bite the sheep, and at the time of my visit two sheep had already been killed by them, the vipers nearly always biting in the face or throat. Among other small earnings may be mentioned that of the thatcher, who receives 1*s.* per corn-stack, besides his harvest-wages, and 8*d.* a day extra for thatching hay. Trussing stover (hay made from artificial grass) is paid for at the rate of 20*d.* per ton. In the autumn "topping and filling" the mangolds—that is wringing off or cutting off the tops and filling the tumbrils—costs 8*s.* an acre, and the same price is paid for "hilling up" the swedes in readiness for cutting when the hoggets and sheep are turned upon the land. I have already stated that overtime, instead of being coaxed out of the men by beer, is paid for at the rate of 3*d.* an hour. If any necessary work falls to be done on Sundays, it is also pair for as an extra. The stockman, besides 16*s.* a week, gets a penny a score for all the eggs he collects. His wife attends to the poultry, and makes 3*l.* or 4*l.* in the course of the year. The sheep-washing is done by Mr. Mathew's own men. The four who stand at the tubs and wash receive 3*s.* a day and their board; and the shepherd has 35*s.* with which to buy meat and beer.

These details will give some notion of the possibility of adapting the piece or task system to a good deal of farm-work. The result of such a system is encouraging to the men, and a source of profit to the farmer, because he gets more for his money. But the farmer, I repeat, if he wishes to be well-served under this system, must lay down a scale of payments in no grudging spirit, remembering the wise saying of old, "There is that scattereth and yet increaseth." If a man finds that by "working his heart out," as the common phrase runs, he can only earn a few pence more than by lounging through the day, he will reckon naturally enough that it is not worth while to task his strength and energies for so small a gain. No doubt, also, there are men constitutionally indolent, self-indulgent, and careless of the future, who will never do a stroke more work than

they can help doing. For instance, a farmer, who writes to me about piece-work, speaks of labourers who, working on his farm at day wages, finish their "score" or "stint" by one o'clock day after day. "I say to them, 'Why not work three or four hours longer, as you very well can, and earn half as much again, say 3*s.* 6*d.* instead of 2*s.* to 2*s.* 6*d.* a day?' They reply, 'No, master, we don't want no more money! We've arned as much as we care about! We'd ruther go home and smoke a pipe!'" Indifference of this kind is common to races of a lower type in countries where the means of living are easier than they are with us. The negro will hoe or dig in the cane-piece up to noon, and, having earned his shilling, no persuasion or hope of earning another shilling will induce him to begin again. But I cannot think such cases common in England, where the struggle to live is so keen, and opportunities of earning money with comparative ease are so seldom within the peasant's reach. Education will certainly diminish this indifference. Even now plenty of English peasants are ready to jump at the chance of earning more money by piece-work.

Besides the general tariff for various descriptions of piece-work established by Mr. Mathew, special arrangements are made from time to time for special work, and the terms are generally committed to writing. I have already given a contract entered into for harvest-work. Here are two more. The first is an agreement made with four men "to do the work upon the field called Forty-two Acres, to be planted with mangolds or turnips as follows:—To fill and spread the muck-hill now standing upon the field for the sum of 3*l.* 5*s.*; and, when the plant is ready, to hoe the same three times, if necessary, for the sum of 8*s.* per acre, and to do the work in a proper and workmanlike manner." The farmer, on his side, undertakes "to do the horse-hoeing, or pay for the same being done well, as many times as the field is hoed by hand." The second agreement is a hiring of a labourer who is "to look after four horses" and do the farm work, "being paid as under:—When by the day, at the usual wage paid to other able-bodied men upon the farm; to do the ploughing at 1*s.* 4*d.* per acre; scarifying and crab-harrowing (4 horses), 3½*d.* per acre; harrowing (light and heavy), 3*s.* per score acres; subsoiling ridges with grubber, 5*s.* per acre; Cambridge rolling, 3*d.* per acre; heavy iron rolling, 3*d.* per acre; splitting down ridges with single plough, 1*s.* 6*d.* per acre. The said C. D. to occupy a cottage, and give up possession thereof when he ceases to work for the said W. M., and to have 1*s.* per week for overtime and Sunday attendance upon horses and stable work. During harvest, to have the same money as other men upon the farm." No time of service is

fixed in the agreement, but a tolerably good guarantee for the length of it is afforded by the provision for surrender of the cottage when the labourer ceases to work on the farm. Substantially, though not in terms, this is a yearly hiring.

Thus piece-work is not an inelastic system, only possible in one or two descriptions of farm-work, but is capable of application to the varied round of agricultural operations. The Knettishall method, carefully thought out as it has been, may be susceptible of improvement. Each farmer, on this question, must think and act for himself; and it will be all the better if he takes his men into his councils and talks over the subject with them in frank and friendly fashion, gleaning from them what their views are both as to principle and details. I do not know that I can put the labourer's view more strongly or forcibly than it was put by a sturdy Cambridgeshire peasant, with whom I had some talk. "Look here!" he said. "What encouragement have I to do my very best all day long, when some chaps alongside of me do not do much above half what I do, and yet earn just as much wages? This sort of thing gives a man a bad heart, I can tell you."* The system of day-wages, in fact, handicaps the quick, conscientious worker in favour of the slow, unconscientious worker, and thus favours skulking all round.

An Exning farmer, Mr. Sabin, told me he put out the following work to be done by the piece: turnip-hoeing, both hand and horse, ploughing, spreading manure, drilling, and cutting and cleaning turnips for sheep, at so much per acre; and dressing corn with the machine, paid by quantity. This represents a considerable portion of the agricultural work which falls to be done throughout the year; and the harvest, occupying four or five weeks, is paid for by the job also. "No body of men," Mr. Sabin told me, "can be better satisfied with the system than mine are." They draw their weekly wages at the current rate (13*s.*), and at the end of each quarter there is a settlement, when they receive the surplus due to them. Thus the men always have money accumulating, and it is paid to them in a lump, so that when it

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* Arthur Young in his 'Inquiry into the Propriety of applying Wastes to the better Maintenance and Support of the Poor,' has this oft-quoted passage:—"Go to an alehouse-kitchen of an old enclosed country, and there you will see the origin of poverty and poor-rates. 'For whom are we to be sober? For whom are we to save?' (such are their questions). 'For the parish? If I am diligent, shall I have leave to build a cottage? If I am sober, shall I have land for a cow? If I am frugal, shall I have half an acre for potatoes? You offer no motives; you have nothing but a parish-officer and a workhouse. *Bring me another pot!*'"

Whether a bit of such waste as could now be given to the peasant would reward his industry, is more than doubtful; but if we give him the opportunity of earning higher wages by greater industry, and thus of saving money, surely a much more adequate motive is at once supplied to him for the exercise of diligence, sobriety, and frugality.

comes it stops many a gap in the family expenditure. The men make two or three shillings a week over their nominal wages. As to the farmer, he has equal, perhaps greater, cause for satisfaction. Instead of requiring upon 630 acres of land nine single ploughs with eighteen horses, he gradually dropped down to two double ploughs with six horses, and a single plough for occasional use. He also found that, whereas a man's average daily work in drilling used to be about nine acres, it rose under the piece-work system to thirteen acres; and on one occasion a labourer, to show what he could do, got through sixteen acres. Mr. Sabin estimated that, by introducing piece-work upon his farm wherever he could do so, he saved nearly ten shillings an acre in labour, while his men were better paid, and of course better satisfied. At first, his bailiff raised every obstacle to the new method, clinging to the old ways, as bailiffs, like other men, often do, because the ways are old. Some time, however, after piece-work was shown to be a success, the bailiff came to the farmer and said, "I think, sir, I might as well leave you." "All right, John!" was the answer. "But why?" "Because, sir, I have so little to do now. Nearly all my time used to be taken up in running about after the men and seeing that they did their work, but now they go straight ahead and want no looking after."

Doubtless there is some good-humoured exaggeration in this way of putting it. We must not expect that, with piece-work, the necessity for looking after the men will cease; only the surveillance will take another form. It will be directed to the quality instead of to the quantity of the work; the men will not want watching to see that they keep at work, but to see that the work is not scamped. Surely, however, increasing education, and therefore increasing self-respect, will make it possible to rouse among agricultural labourers that feeling of pride in their work which is latent in every class of worker.

Mr. C. S. Read, M.P., kindly supplies me with the following pregnant illustration of the advantages of piece-work to the farmer, as well as to the men:—"I am now paying," he says, "some common labourers 1*l.* a week at task-work, while the other men at day-work are receiving only 13*s.*, and yet I am sure that if the task-work were done by the day, it would cost me ever so much more than I now pay for it." Again, to show what men can really earn, and what it may be worth the while of an employer to pay, I take the following extract from the farm cash-book of Mr. J. H. Arkwright, of Hampton Court, Leominster. It has been published in contradiction of statements made as to the wages earned by one of the labourers mentioned in the account, who has since become the most prominent member of the National Labourers' Union. I do not, however, care to enter

into this controversy, nor is this extract reproduced here because of its mention of Mr. Arch, but only because it illustrates the result of piece-work, both in testing and rewarding exceptional capacity or diligence :—

	£	s.	d.
" *February* 22*nd*, 1860.			
Paid Joseph Arch and John Ivens for laying 26¾ perches fencing, Hill House land, Newton, at 1*s*. 3*d*.	1	13	5
Paid ditto, 74¾ perches, Hill House Farm and Newton Court, at 1s. 1*d*.	3	14	9
By J. H. Arkwright, paid their expenses from Hereford to Dinmore	0	2	4
Ditto, from Dinmore to Stratford-on-Avon	1	10	0

Note.—The above are Warwickshire men, and have been 12 days each at the above, 4*s*. 6*d*. a day."

Mr. Arkwright adds :—" The pay was fair, and the work well done. At that date, 14 years ago, our own hedgers could have made the same wages, viz., 27*s*. a week, if they could have done the same amount of work. This incident, more than anything else in my experience, has proved to me that wages must be gauged by individual capability, not by a fixed tariff. Otherwise, all being equal, Mr. Arch should have shared with the natives here what he earned over and above what they could make at the same work." Nor did the 27*s*. a week paid to these two hedgers represent the whole cost of the work, for it will be seen that Mr. Arkwright paid travelling expenses equivalent to 1*s*. 4*d*. a day each, in addition to the wages. We may presume, therefore, it must have been worth his while to pay at the rate not of 27*s*., but 35*s*. for the work done.

3. It will be gathered from the foregoing remarks that task or piece-work is given by many employers in the Eastern Counties, as no doubt in most other parts of England, though seldom as part of a regular system. Of course, wages are increased by the extra earnings thus realised ; and high pay at harvest is another addition, and a material addition, to the year's income of the labourer.

The system of payment at harvest time which prevails in the Eastern Counties seems open to some question. During the harvest month, sometimes a little more, occasionally a little less, the men earn nearly three times as much a week as they earn during the rest of the year, though they certainly do not work twice as hard. One farmer says that the increased work done by his men during harvest would be fairly represented by a fourth of extra pay. The men like these " lump " payments, which, however, are generally mortgaged for rent or boot and shoe bills, or to meet the claims of the small shopkeeper ; while, if they are

not so applied, they lead at times to waste and extravagance. "Quickly come, quickly go;" and the money soon burns a hole in the pocket of the unmarried labourer, unless he has more than an ordinary share of prudence. The zeal of harvest labourers is stimulated by higher wages at that season all over England. But outside East Anglia such wages as 2*l*., 2*l*. 10*s*., and even 3*l*. a week, for harvesting, I believe, are nowhere given. If these wages could be spread over the rest of the year and hirings were made yearly or half-yearly, the labourer would be much better off. At present he earns least when he wants most. In the winter months wages are sometimes reduced by a shilling a week, on account of the smaller quantity of work done; and the opportunities of earning extra money by piece-work must be fewer than they are during the summer. More food, too, is wanted, with more warm clothing and more fuel. But when the pinch comes at this time, the harvest earnings are generally gone—not necessarily ill-spent, but spent without that thrift and regard for actual wants which would guide both housewife and wage-earner if the money came in regular weekly sums all through the year.

I know of one instance in which a Suffolk farmer has acted upon this view, and with the consent of his labourers is now paying the able-bodied men an average wage of 18*s*. weekly, upon a yearly hiring. It is an experiment, and in Suffolk, at least, a novelty, though less of a novelty than at first sight appears; for I repeat that it only applies to the staff of able-bodied men generally, terms of hiring already recognised in the case of the shepherd and one or two other hands on almost every farm. I have said that farmers object to long hirings because if a man grows discontented, or if a difference arises between him and his master, he ceases to work with any will or spirit—ceases to give remunerative work, and had better go. The yearly hiring, it is contended, is a premium upon the growth of disaffection and discontent among the men at a season when it would be their interest to leave their employ. For example, they might work at the 18*s*. rate while the days were short and the work was slack, and they might leave their master in the busy season. In case, however, of any breach of agreement under such circumstances, the master has a summary remedy at law, and, whether the agreement were enforced or not, a labourer who left his employer in the lurch so unhandsomely would find it difficult to gain other employment upon like terms. Employers, for their own safety, would be careful whom they hired by the year, and would generally, from previous personal acquaintance or as the result of good references, know something of a man's antecedents before engaging him. Such a hiring, including "haysel" and harvest, would secure the employer against being

suddenly left without hands at a week's notice. It would also give the labourer and his wife no temptation to squander what to them is a large sum of money now earned at harvest time. One incidental advantage of such a contract would also be that the labourer's position, in respect of wages, would then be much clearer than it is, both to himself and outsiders.

The co-operative system of labour which I have described as prevailing at harvest-time on the Knettishall farm has great recommendations in theory, as in practice. Under the usual system which prevails throughout the Eastern Counties in harvest-time—that of giving each man a lump sum for the harvest—it becomes the labourer's interest to get the work out of hand as quickly as possible. Still there is then not the same bond of interest between the workers; they are dealt with separately by the farmer and are not brought into the same close relationship with each other as when they join in contracting for the job. The sense of a common interest in the work in hand not only supplies a wholesome stimulus to exertion, but is a good educator. Whatever system of labour brings out of a man all his power, or, let us say, most of his power, must be the best system, both for master and man, in agriculture as in all other callings. Economy in farming is, I am convinced, not only compatible with higher wages, but will be promoted by higher wages,* the condition precedent being always understood that the wages paid are for work actually done, and not for work merely supposed to be done. In modern farming, I repeat, there can be no more important point for study to-day than the introduction and perfection of a system which shall enable employers, according to the circumstances of each district—it may be of each farm—to apply this test in the payment of wages, and gradually educate both their labourers and themselves up to payment by results.

4. Horse-labour is necessarily a large item in the farmer's labour bill. The double-furrow plough has saved something both in manual labour and in horse-labour. One farmer estimates the saving at 10*d.* per acre in men, and at the same amount in horses. Where one man and two horses plough one acre with the single-furrow plough, one man and three horses

* "I think we do not often consider how much low-priced labour (which is not necessarily cheap labour) has retarded agricultural improvements. Low-priced labour has rendered the farmer indifferent to the extended use of machinery, and careless of the minutiæ of his business. Low-priced labour has in many cases contracted the hours of work, and made the work slovenly and unprofitable. Low-priced labour has rendered the labourer physically incapable of exertion, and degraded him too frequently into habitual pauperism."—Mr. Little on 'The Future of Farming.'

will plough about $1\frac{3}{4}$ acre with a double-furrow plough. But this—perhaps the only implement recently introduced which saves an appreciable amount of labour in the cultivation of land—can only be used on light and medium soils.

The farmer whose estimate has just been quoted reckons that the cost of keeping and replenishing a horse, and of paying farrier and harness bill, amounts to 18*s.* per week per horse, say 47*l.* per annum each horse. "It would be fair," he adds, "to assume that a farmer keeps in regular work from three to four or more horses per 100 acres." "Horse-labour, therefore, costs from about 28*s.* to 42*s.* per acre per annum, varying with the nature of the soil." But the cost of horse-labour must vary also according to the machinery used on a farm, and the cost price of raw material in the shape of young horses. "My horse-labour," says another farmer, "has decreased in cost by about 6 per cent. within the last seven years; but this decrease is caused by machinery provided in the form of well and pump, with water-pipes about the yards; 150*l.* being spent in this way to save the daily expense of pumping and distributing." Another farmer writes:—"I should put the diminution in the number of horses kept within the last few years at from 5 to 10 per cent., partly owing to the great advance in their price, and partly to the extensive use of the double-furrow plough, which has also caused a great saving in manual labour."

The following is "the estimated cost of horse-labour per acre on a mixed-soil farm of 690 acres at Fornham St. Martin, Suffolk:—

Acres.	
550	Arable net.
90	Pasture gross.
50	Roads, farm-premises, house, gardens, hedges, ditches, &c., works out about:—

£	s.	d.	
1	16	0	on 550 acres of arable.
	4	7	on 90 acres of pasture.

"This calculation is made on the following basis:—The present price of both horses and horse-keep is very high; 22 horses, each costing 46*l.* per annum, exclusive of horse-keeper's wages (which would come under the item of manual labour); and no charge is made for straw, the manure being considered an equivalent:—

	£	s.	d.
Death, risk, and depreciation	7	0	0
For 38 weeks' corn, chaff, hay, &c.	28	14	6
For 14 weeks' corn, green food, &c.	6	8	10
Interest	2	10	0
Veterinary, shoeing, fire insurance, &c. ..	1	6	8
	£46	0	0

"The horses are supposed to be worth, on an average, 50*l.* each."

The cost of manual labour on these 690 acres from October 11, 1873, to October 11, 1874, was 1209*l.* 15*s.* 6*d.*, or at the rate of 1*l.* 15*s.* 0¾*d.* per acre, not far off the cost of horse-labour. The horses now find harvest time a trying one. Formerly the men used to do the hard work. Now the horses and the machines together relieve the men from what our neighbours across the Channel would call the brutalising labour which used to fall upon them. The more intelligent the labourer, the more keenly he appreciates a result which saves his strength, while it has raised, instead of diminishing, wages.

5. Almost invariably throughout the Eastern Counties, when cottages are let by the farmer or the landowner, they are under-rented. Various questions of importance are suggested by this fact. One is the hindrance to cottage improvement thereby created. If the landowners were sure of receiving a fair interest upon outlay, instead of merely a nominal rent, the substitution of new and roomy cottages for old ones of a bad type rapid. Upon this point, however, I need not dwell. The only point material to the present inquiry is the addition which is indirectly made to the farmer's labour bill by this system of nominal rent. At present the labourer really has a house and garden in part payment of wages; and whether the cottage and garden are rent-free, or are merely under-rented, makes no difference in principle; it is merely a question of degree.

In cases where the cottages are let direct from the landlord, as I have said elsewhere, it comes to this—that A, who is employed by C, relies upon B for what is really a portion of his earnings. It may be that B, the landlord, recoups himself for the loss upon A's cottage out of the rent paid by C, the farmer, for something else. But though landowners may indirectly recover from the farmer what they lose in dealing with the labourer, the system is a roundabout one which should be put an end to. I have heard of complaints by landowners that, after spending large sums in building good cottages for labourers, some farmers have used these cottages as a means of keeping wages low. Such complaints, if well-founded, show not only that the cottage is one element in fixing wages, but that landowners do indirectly contribute in this way towards the wage-fund. In order to ascertain how far the peasant's cottage is under-rented, it is worth while here to compare some good town-dwellings built for the working-classes—artisans and labourers—with the good modern cottages which are rising up slowly, though more rapidly than one could reasonably have expected, throughout the Eastern

Counties. At Lavender Hill, not far from Clapham Junction, in the south of London, there is now upon the Shaftesbury Park Estate what is popularly known as "the Working-men's City." The houses there are of four classes. Those of the lowest and cheapest class, which need alone be mentioned here, contain five rooms—two living and three bed-rooms—and the weekly rental charged for them is 5*s.* 9*d.*, including rates and taxes. Having inspected the Lavender Hill dwellings, and visited in all parts of Suffolk three-bed-roomed cottages of the same class, I can speak of their relative merits with some confidence. The town-houses have the advantage of gas and water (though these requisites, of course, involve an extra payment), a system of drainage, and air-shafts and valves which secure a free ventilation in every room. The tenants also enjoy the benefit of easy access to schools, a lecture-hall, and shops, or a co-operative store, where marketing can be done cheaply and quickly. By common consent of the tenants, it may be added, no beer-shop or other place for the sale of alcoholic drinks is allowed upon the estate. On the other hand, few of the people who live here are as near to their work as the farm-labourers, even those living in the villages; while they are under a still greater disadvantage in comparison with the labourers for whom cottages have been provided upon the farms on which they are engaged. Probably the majority of the inhabitants at Lavender Hill must travel to and from their work by means of the neighbouring suburban railways; and the weekly railway fare, even at workmen's rates, represents a substantial addition to rental, with a liability to increase at the discretion of the Railway Directors.

Plenty of peasants' cottages throughout East Anglia may be fairly contrasted with these workmen's dwellings. I wish the number were greater than it is. But, as I have said, much is being done to increase the number; and the wonder is, with the inadequate rentals yielded by such cottages, that they should increase in number at all. The rooms of the modern cottage are of about the same size, and give the same accommodation, as those of the houses at Lavender Hill. There is invariably an oven for bread-baking, not always one for each cottage, but one for each pair, built in the rear; and generally there is a common copper for brewing. These two economies, practised as a matter of course by the villager, are impossible to the workman in any large town. The pig-sty, with its useful inmate, and the garden yielding good crops of vegetables, must not be omitted; and here, again, these things are not for the workmen in towns.

The comparison, however, may rest not upon relative accommodation, but actual rental. Now, while 5*s.* 9*d.* is thought a

fair weekly rental for the five-roomed houses at Lavender Hill, 2*s.* would be thought a high rent for cottages which may be favourably compared with these houses for internal accommodation, and far surpass them in respect of gardens, supply of vegetables, power to bake and brew, command of pure air, nearness to work, and pleasant surroundings. It follows that in actual rental alone there is a difference of 3*s.* 9*d.* a week against the town-dweller and in favour of the peasant, while the produce of the garden and the profit of pig-keeping go to increase the relative advantages of the latter.

Next as to cost of construction. If a man wishes to buy a five-roomed house at Lavender Hill, the price is 170*l.*, exclusive of law charges. For this sum, however, he does not secure the freehold: he holds the house on a 99-years' lease, and must pay an annual ground-rent of 2*l.* 12*s.* If this ground-rent be capitalised, an addition of say 50*l.* must be made to the purchase-money, which will then come to 220*l.* On the other hand, we may reckon that the peasant's cottage costs about 150*l.*, setting down nothing for the value of the land. Averaging the rent at 1*s.* 9*d.* a week, we have a yearly return of 4*l.* 11*s.* from this investment, or about 3*l.* per cent. From this return, however, must be deducted rates and taxes, insurance, and repairs. There is no deduction for occasional loss of rent, nor is any account taken of the land occupied by the cottage and garden. When a moderate allowance has been made under each of these heads, what remains for the landlord? Barely 2½ per cent., and as soon as a cottage has seen its best days, even less; while the lowest dividend realised by the Artisans and Labourers' Dwellings Company at Lavender Hill is 6 per cent.: and Lord Shaftesbury has stated that the Company might have divided 10 per cent.

Hitherto cottages in the country have been compared, in rent and accommodation, with new dwellings recently provided for labourers and mechanics in the suburbs of London. But comparatively few town labourers can afford to live so far from their work. We shall now see what sort of lodgings they are able to procure in the heart of London. The private letter from which I take the following extract was written by a gentleman intimately acquainted with the district he describes, with the wages and mode of life of town labourers there, and the rent they commonly pay:—

"Within a two miles' radius of this spot (he refers to a street in Southwark) a front room, 12 feet square, would let for 4*s.* a week, a back room, 8 feet or 9 feet square, would be about 2*s.* 6*d.* to 3*s.* A small house in courts and places with no thoroughfare, containing four rooms about 7 feet square, would let for from

6*s.* 6*d.* to 8*s.* 6*d.* weekly. These places are in closely-packed neighbourhoods, where the clouds are only to be seen as you put your head out of the window. A labourer with 21*s.* per week, and two children, must pay for one front room 4*s.* per week—10*l.* 8*s.* per annum. The washing and all domestic things must be done in one room, and the clothes dried there. Again, suppose—which is often the case—a drunken, noisy family is living in the room above and keeps late hours. A man goes home tired to his room, wanting sleep. He will soon wish himself back in the country. In some places there is only one closet for five or six families, some of whom are very dirty people." In another letter the writer says:—"Not one poor person out of six has a cooking stove. The meat must be boiled or sent to the bakehouse. Very few mechanics have more than two rooms; to have three rooms, a man must be very careful and steady. Taking all things, I think London is cheaper than the country for living (food). But a London labourer has no garden to grow vegetables. All must be bought."

Is it not clear, then, that wages which in large towns are higher in money, but subject to deduction for higher rent, are in the country really supplemented by the difference, whatever it may be, between fair letting value represented by cost and actual rental of cottage and garden? Whether the farmer or the landlord makes this contribution to wages, or whether it is a joint contribution by both, will depend upon the agreement subsisting between them as to cottage building or letting; but this question is one which affects only themselves. The benefit derived by the labourer in respect of rental is in no way touched by the relations between landowner and farmer.

The system is so general and so deeply rooted that one has faint hopes of seeing it changed. But both in theory and in practice it appears indefensible. The labourer is seldom conscious that in fact he receives an addition to his weekly wages, in the shape of deductions from rent, even when he pays a weekly rent for his cottage. In one instance the fact was brought to his knowledge in a very homely but forcible fashion. The story will bear repeating. It is told of an East Anglian rector, who, when in his parish the labourers, living for the most part in under-rented cottages, were complaining of low wages, had this dialogue with his gardener, perhaps with a view to teach others by example:—"Let me see, John; what wages are you getting?" "Eighteen shillings a week, sir." "Are you satisfied with your wages?" "Yes, sir, quite satisfied." "Very well, John; then I shall raise them 3*s.* a week, and give you a guinea." John was overcome with gratitude. "Oh! thank you very much, indeed, sir! Thank you!" "Yes, but John, I shall

raise your rent 3*s*. a week too." John would hardly feel constrained to say "Thank you" this time; but if the cottage were worth 3*s*. a week more rent than John was paying for it, it is not clear that he could have urged any valid objection. As I have said elsewhere, to give with one hand and take away with another leaves the wage-fund where it stood before; but this readjustment of rental and earnings puts the relations between employers and employed on a much sounder footing, for wages then really mean wages, and rent means rent. At present both are arbitrary nominal terms which do not indicate what they really represent. The wages are not represented by 13*s*. or 14*s*. in money, but by a mixed payment in coin and kind, not easily estimated; varying as rents, cottage accommodation, and size of garden do vary even in the same parish and upon the same occupation; and misleading not only outside critics, but the very parties to the contract, who only see dimly where they stand.

Such a system must be full of anomalies, and also of injustice to individual labourers. The possession of a good cottage is often a matter of mere accident. The labourer to whom it is allotted receives an addition to his wages, as we have seen, though perhaps he works no harder or better than his fellows. Through accident, again, the cottages upon one estate or upon one farm will often be far better than those upon an adjoining estate or farm. The labourers in both cases will receive the same nominal wages, but those who occupy the good cottages are really in receipt of higher wages than their neighbours. These inequalities would disappear if you could reckon the average amount now received indirectly by labourers in the shape of under-rent; and if you paid this amount in money, requiring them, on the other hand, to give for their cottages a rent representing actual value. But it would be necessary, in strict justice, that this increase in money wages should be paid to all the labourers employed whose labour was of equal value. When the men were the tenants of their employer, they would be no better off through the change. Like the rector's gardener, they would receive with one hand and pay away with the other. But if men live in cottages which they do not rent from their employers, the same process will not necessarily be gone through. The addition to their wages, which equal justice requires, need not be paid away in extra rent, for it may be that they can get no cottage which is worth so much more money.

6. Perquisites are probably given on much the same scale in the Eastern Counties as in other parts of Southern England. Beer is the chief, and certainly the most objectionable of these gifts

in aid of wages. This item appears in the accounts of every farmer as an addition to his labour bill. If the labourer is kept at work a little longer than usual, or is employed on harder work than usual, he goes to the house for his pint or quart of beer. Certain kinds of work carry with them an understood claim to drink. In harvest-time the consumption is enormous. An East Suffolk farmer gives me the following statement on this head:—"We always allow each of our men," he says, "three bushels of best malt for harvest. Out of each bushel the men make from nine to ten 'pails' of three gallons." A pail is the Suffolk measurement in home-brewing. "They have, therefore, from 27 to 30 pails, or from 81 to 90 gallons, as the case may be, for the harvest, which in average years lasts 27 days. Besides this quantity of beer, a 300-acre farmer never thinks of giving away less than 36 gallons, or a barrel, of what we in Suffolk call harvest beer, which is specially strong and is generally brewed during the previous March. This is exactly what goes on year after year in this district with regard to beer allowance. I have often seen men come with empty bottles during the last few days of harvest, and get their fellow-labourers to give them some; and I always give them some myself, if I know they are without."

When the weather is very hot, or any special effort is called for through fear of rain, I have heard of a big stone bottle being sent into the harvest-field filled with spirits and water. Admitting that some beer is needful to enable the labourer to support the heat and burden of the day, the system of beer-doles at harvest, as at other times, seems to be little less than a premium upon excessive drinking. The farmers say, if the men did not brew for themselves, they would buy public-house beer, made heady by one knows not what ingredients, and would be unable to work upon it. On the other hand, is it not better to give the men the value of the malt and hops, and thus give them some inducement to drink less? In Forfarshire, as we have seen, the labourers receive milk as a part of their weekly wages. We do not hear of much beer or spirit-drinking while they work, yet we know how well they work. Farmers say that the men like beer-perquisites, and will do more for a pint of beer than they will do for twice its equivalent in money. One can quite understand this craving. The same story is told in the cider counties. I think it will be found that in districts where drink is doled out in the greatest quantity, the type of labour is the lowest; and, whether the labourer likes it or not, this vicious system should be abandoned. If work is being done, not adequately paid for by current wages, the extra earnings should be in cash. As it is, the labourer drinks far more than is good for him, and pours

down his throat what he ought, in the form of money wages, to carry home to his family for such food as would give himself and them greater strength and stamina. In the harvest-field, too, one cannot help thinking that so much beer must tell upon many men, depressing their energies and hindering work instead of expediting it.

The produce of the garden or allotment, or both, can hardly be called a perquisite, though it is certainly a privilege, and a valuable one. The labourer uses his leisure to raise vegetables, or sometimes a patch of corn, and he cultivates his quarter of an acre, more or less, to a profit. I am glad to say that, with some exceptions, allotments in the Eastern Counties are let at a moderate rental. Occasionally the men have a potato-plot rent-free, and this, of course, is a supplement to wages, representing a small addition to the labour bill. I have met with cases in which the farmer ploughs his men's land without charge.

Sometimes the farmers object to pig-keeping. There is a special objection to this bit of thrift in the case of horsemen or carters, because of the access these men have to the corn and their opportunities of peculation. The temptation, it is said, is so great in such cases, that men ought not to be exposed to it. Where the farmer does not allow pig-keeping he often gives manure for the allotment. Sometimes corn is sold for the use of the pig at market rates. Straw is given for the same purpose. Milk is occasionally given or sold at a nominal price, but is not always valued as it should be, perhaps because it has to be fetched. Brushwood or underwood is given or sold at nominal rates. Then there are the Christmas gifts of beef or money, and the farmer's subscriptions to the boot or clothes clubs of the parish. These are voluntary gifts, no doubt, and their value is not easily assessed. Neither would the farmers wish such gifts to be regarded as more than good-will offerings, which help the labourer to tide over the winter and tend to promote kindly relations. There remains for notice the help given to the poor from the farm-house in illness—help freely given, and looked for almost as a right by the recipient. Wine, brandy, arrowroot, and other medical comforts, are asked for and given, with very little sense of dependence on the one hand or of patronage on the other. In remote country parishes, where the nearest surgeon probably lives miles away, the great house, the vicarage, and the farm-house are dispensaries, and something more. In the towns, labouring men or mechanics would never dream of asking for such help, and many of them perhaps would spurn it with some indignation if it were offered. The same independence is hardly possible in the country. The farmer or the farmer's wife does not grudge this relief, but it has a money-value, and though no farmer would

think of setting it down to the account of labour, such is really the form it takes to outsiders.

7. Of greater importance than perquisites is that item in the labour bill which I have described as "wages knowingly given by the farmer in excess of the value of the labour given in return, as in the case of old and infirm hands;" or, it may be added, wages paid during wet or frost, when agricultural work cannot be done; or in the short, dark days of winter; or when boys are employed, as they sometimes are, though not really required, "because there is such a large family."

"To show how the old men hang on and the young ones go away," writes a Suffolk farmer, "take my farm. I employ 20 men: 13 of them are above 50 and under 75, the majority ranging from 60 to 65, while only 7 men of the whole 20 are under 50. Yet all these men are on full pay, although they are certainly not worth it. Several have worked on the farm for 30 or 40 years. I maintain that I pay 30 per cent. more in wages than the work is worth in the market. But neither I nor any other decent farmer would turn a man off simply because he was old. Hitherto it has been the custom to 'find a corner somewhere' for men who have grown old in a place."

The statement here made is true of hundreds of farmers in the Eastern Counties, and no doubt in every English county. This particular farm is an extreme case; but on a smaller scale, go where you will, you find old servants retained upon farms, sometimes receiving full wages, sometimes treated as "three-quarters" or "half" men, but hardly ever earning the wages paid them, if judged by the standard remuneration given to labour in the parish. This regard for old services is highly honourable to the farmers. No one will pretend to say that they are the only class of employers who consider the claims of old and partially worn-out servants. But it may be said with truth that there is no other class of employers who employ this unremunerative labour to anything like the same extent. The result must, and does, tell upon the labour bill. The older men are really receiving an annuity for past services, represented by the difference between their wages and the value of their labour. It follows that either these annuities must come out of profits, or the wages of able-bodied men must be lower than they otherwise would be in contemplation of the provision which the farmer is expected to provide in old age.

In winter the hours of labour in Suffolk, and generally throughout East Anglia, are (nominally) from 7 A.M. till 5 P.M., with an hour for dinner. In summer the hours are, with somewhat greater reality, from 6 A.M. till 6 P.M., with half an hour

for breakfast and an hour for dinner. The year's work is thus summed up by one of my informants:—"Harvest-hours, twelve hours' actual work. Summer, ten hours' actual work. Winter, eight and often not more than seven hours of actual work. We lose time sadly in winter, and farmers who pay, as I do, wet or dry, then get very poor value for their money. Several days last week (in December) my men did not do two hours' work a day. In a factory men are not paid if they do not work." It is a nice question in farming whether the men or the master should suffer if the weather renders farm-work impossible. In the old days of flail-threshing, work could generally be found under cover in case of continued rain. Machine-threshing has put an end to this resource, and it is often impossible to find a job for every labourer in-doors when field-work is stopped by the wet. Under such circumstances, when the labourer is ready to work but cannot, should he be mulcted of his pay, or should the farmer pay for work not rendered? The equities on both sides seem equal, and a hard economist would probably say, with some show of reason, that the employer should not pay if he can receive no equivalent. Most persons, however, will hold that the hiring should not be a daily but a weekly and continuous hiring, and that the farmer should take his chances of the weather. In practice this rule is general among the large farmers when men are upon weekly wages; when they are upon task-work, of course the risk is theirs. The contrary rule is still too frequently in force, and there is no greater cause of suffering among the men, especially when, as in the South-Western Counties, the rate of wages is low, the liability to wet great, and piece-work is either rare or badly paid.

I hope most earnestly that farmers will not engage their labourers upon this niggardly system, deducting for wet days from the wages of men who can ill afford to bear such deductions. We cannot help seeing, however, that, if the farmer in such seasons pays for work which is not performed, he is equitably entitled at other times to ungrudging work for longer hours than are usual in other employments. There can be no exact adjustment of labour throughout the year, no self-righting balance struck between seasons when field-work is easy and may be prolonged, and other seasons when it is difficult and when "all pay and little or no work" hardly exaggerates the employer's situation. The difficulty is in impressing upon the men what any impartial outsider must see, and what they must see if they will conscientiously consider the case, that when the contract with them is "wet or dry," they are really paid in the short, dark, rainy, or frosty days of winter, wages out of proportion to those paid during the summer months. In other words, an average is struck throughout the year; they may be paid less than their work is worth in

summer time and more than it is worth in the winter; and unless they work well in summer all through the day, they do not give back what they have received. Agricultural labour must be distinguished in this respect from most kinds of town work. The farm labourer cannot, like the factory hand and many artisans, work by artificial light. He must follow the sun, and, in a fickle climate like ours, cannot always even do that. Employers of labour in manufacturing towns, and indeed any persons who wish to form a fair judgment upon the wages paid to farm labourers, must take into account the inevitable condition under which these men work and farmers have to make their living. By all means let us sympathise with the English peasantry, where they deserve sympathy, as they often do in their dwellings and surroundings; but our sympathy ought to be an intelligent one, based upon a correct appreciation of the circumstances under which they work, and a fair allowance for the difficulties of those for whom they work. It will perhaps be enough to ask this question—What is the system of paying operatives, like masons, whose labour is interfered with by weather? And upon what system would mill-owners pay factory hands, if this species of work were liable to similar interruptions?

8. Poor's-rate may hardly seem admissible as an item in the farmer's labour bill. It is true that Boards of Guardians no longer give relief in order to make up insufficient wages; but poor's-rate presses with peculiar force upon farmers who are the only employers and often the only ratepayers in a country parish. Sometimes, indeed, one farmer will occupy all the land in a parish. In a town, payment of the poor's-rate is spread over many different classes and interests—manufacturers, merchants, tradesmen, professional men, clerks. It is confined in the country to one class and one interest. Unhappily the present system of poor-relief not only gives no encouragement to thrift, but often discourages it; and in rural society the one employing-class, after paying fair wages to labourers in their prime, may afterwards be compelled, and they alone, to support these very labourers, often brought to the poor-house through their own improvidence. We must bear in mind also the constant drain of labour from the country to the town. The young and the strong are forced to migrate, or take their labour to what they think a better market, leaving behind an undue proportion of old and weakly men. The rates clearly suffer, owing to this migration.

With regard to the probable future cost of farm-labour, Mr. Stephenson, of Burwell, whose communication has been already

quoted, writes to me as follows: — "The principal change noticed by me since the commencement of the recent agitation is the removal by emigration of a large number of those surplus hands on whom farmers depended in times of extra work—such as turnip-hoeing, hay-making, &c.—men who occupied themselves in other ways, or were idle when not required at these times. We may probably look forward to the removal of this class of labourer in still larger numbers; and we may have to depend entirely on our regular hands, excepting at harvest, when the high wages will, no doubt, continue to draw men from other employments.

"I think we ought to consider how far we may have to alter our system of farming, looking forward, as we must do, to the more or less complete removal of these 'odd hands.' The root-crop will, probably, be the only one affected, this being the only crop which necessitates the employment from time to time of a number of extra hands. As the work of hoeing and singling turnips cannot be delayed, it is clear that, if a large amount of surplus labour is not forthcoming at the requisite moment, the acreage of roots must be reduced. As the roots are the worst-paying crop on the farm, to give up half the acreage will leave a greater profit to be shared between landlord and tenant, without any disadvantage to the land. As much stock would be fatted; but they would eat corn and cut-straw in place of roots.

"On good mixed soil much money is lost by farmers being compelled by a lease to grow roots on one-fourth of the whole arable land. Such a wasteful system is only possible by the existence of a large amount of surplus labour. If half this turnip-shift were given up to barley, as recommended by Mr. Lawes,* the following would be a reasonable estimate of the cost and result. The figures speak for themselves:—

"*Estimated Cost and Result of growing a Crop of Swede Turnips.*

	Per acre. £	s.	d.
Team Work—including the usual ploughings, harrowings, rolling, drilling, and horse-hoeing	1	12	0
Manual Labour—including hoeing by hand, singling, pulling, and cleaning; cutting for stock	1	3	0
Artificial Manure	2	0	0
Seed	0	3	0
Rent, rates, and taxes, say	2	10	0
Total cost	7	8	0
If carted from the field, add 10*s.* per acre.			
Value of Crop for Food and Manure, 12 tons at 8*s.*	£4	16	0

* See Mr. Lawes' recommendations in the 'Royal Agricultural Society's Journal for 1873,' vol. ix., part 2, specially pp. 373, 374.

"*Estimated Cost and Result of growing one acre of Barley in place of the above Crop.*

	£	s.	d.
Team Work—including Autumn cleaning, ploughing, usual harrowings, rolling and drilling; also team work at harvest, threshing, and delivering to market	1	8	0
Manual Labour at harvest—threshing and dressing	0	18	0
Coal and use of steam-threshing machinery	0	4	0
Seed	0	15	0
Manure	2	0	0
Rent, rates, and taxes	2	10	0
	7	15	0

	£	s.	d.
Value of Crop, 10 coombs at 19*s*.	£9	10	0
Straw for consumption on farm	1	10	0
Total produce	£11	0	0

"As high-farming consists in consuming on the farm as much corn and cake as possible, it is clear that a landlord, by compelling a tenant to grow an extra amount of roots, defeats his own object: because a farmer of small capital, instead of purchasing food, has all he can do to consume his roots, and thereby only returns to the land a part of what the crop of roots had previously taken out of it.

"Beyond the opinion expressed above with regard to surplus hands, I see no reason to think that labour will be dearer. When I consider that, notwithstanding the considerable pressure that was used to induce emigration from the Newmarket district last year, the wages still remain nominally at 13*s*., I cannot resist the conclusion that an immense deal of emigration must take place from the country generally previous to any further rise in farm-wages. Moreover, there seem to be some signs of a sufficiency of hired labour in America. If such is the case, I do not think that English farm-labourers in regular employment will be induced in any considerable numbers to go to the back-woods to clear forests on their own account."

America, however, is not the only outlet for our surplus farm-labour, and I cannot help thinking that emigration may, in time, cause a dearth of labour. The leaders of the National Union are now concentrating the resources and influence of their organization for the purpose of sending agricultural labourers away to other parts of the country or the colonies. So far as this movement really tends to the benefit of the men themselves, nobody has the least reason to complain of it. On the contrary, it is a natural and legitimate attempt to better the condition of the labourers, and one which will command general approval. Experience has shown that most farm-labourers, at all events in the Southern Counties—and East Anglia may be

included in the list—are far too slow in migrating, and are still more loth to emigrate, even when there is a reasonable assurance of higher wages, cheaper food, and regular employment in a new sphere. We must remember, too, that the agricultural districts will bear a good deal of depletion, not only without injury to farmers and labourers, but with positive advantage to both. It is not really to the advantage of farmers in any district that there should be a redundant population; for if the nominal rate of wages be thereby kept somewhat lower than it is elsewhere, the rates are higher. Moreover, low wages generally mean depression and discontent among the labourers, and bad, nerveless, dear work.

The conditions of rural society are constantly at work to produce in every purely agricultural district this superfluity of blood and muscle. The land, as it is now cultivated, employs a stated number of men and youths. Taking fifty rural parishes in any county, you may predict with tolerable certainty, within fifty men, how many labourers will be wanting there at the end of the next ten years. The use of machinery must increase, and stand, to some extent, in the place of manual labour. Thus, while the demand for labour in the rural districts may be reckoned as pretty nearly fixed, supply is constantly outstripping demand. Our peasantry do not abstain from marrying early and having large families because they know that employment cannot be found for all their children around the villages where they are born. They marry, often improvidently, though probably not more improvidently than artisans or labourers in towns. The result is that, as they must work to live, so they must migrate in order to work. For some years the discovery of coprolites in East Anglia absorbed much of what would otherwise have been surplus labour produced in excess of agricultural wants. But coprolite digging no longer affords a sufficient outlet for the annual increment of population in counties which contain so few large towns and have so few manufactures.

All over rural England the same process of over-population goes on, and the same phenomenon is noted—that, though of all classes, perhaps without exception, agricultural labourers are under the greatest necessity to leave their birth-places, and have the greatest inducement to do so, no class is so hard to move away. Our artisans are pretty nearly absorbed by the development of manufactures and the growth of great cities; but they do not hesitate to go elsewhere if they see a chance of doing better for themselves. The sons of our trading and professional classes are ready at the shortest notice to move off to any part of the world, in order to find elbow-room and opportunities which do not

exist in our own overcrowded communities. Hitherto, however, the English peasantry, who are more valuable colonists, and more likely to succeed, than any other class, if they have average energy, thrift, and industry, are the very people who cling the closest to home, no matter how poor that home may be.

It is impossible to believe that our farm-labourers will long remain so reluctant to stir, and so little adventurous. No doubt one very strong motive-power with them, as with every other class, has been, and always will be, self-interest; and the most obvious explanation of a man's reluctance to go somewhere else is that he thinks he is better off where he is. In part this is a true explanation, though it does not account for the fact that farm-labourers are often content to stay in villages where their labour is not wanted. Education will make them more plastic, readier in adapting themselves to new conditions, and less disinclined to face what to them at present is the unknown. Union agents, emigration agents, and the Union press, are doing their best to educate the men up to this point, and supply information as to the best labour-fields open to them in this country and the colonies. Such being the new influences brought to bear upon the agricultural labourer, not in one part of the country alone, but in all parts, to induce him to leave home, a question of the utmost interest arises, and one very pertinent to the present inquiry—Will the taste for emigration grow, and, after a time, sensibly affect the farm-labour market? Or will it do no more than restore a healthy balance between supply and demand, preventing stagnation at home, and furnishing the British colonies with a steady flow of the surplus labour which we cannot usefully employ? I cannot help thinking that the influences just specified, though, perhaps, at first slow in their operation, will before long make themselves felt, and will gradually force upon the farmers a change in the system of hiring and of work, if they wish their best men to stay at home.

The rural Arcadia of which we can at present do little more than dream is one in which employers will find that the secret of economical farming consists in encouraging men to do their utmost and do their best, by paying them well for the results of work; in which the young men will earn, by task-labour, wages enabling them to live comfortably, and provide for old age out of savings; in which education will make our peasants more intelligent workers, while it will be too widely spread to make them look down on work; in which, also under the influence of education, the labourers as a class will become temperate and frugal, acknowledging the duty of providence, insisting on decent, comfortable homes, and willing to pay fair rentals for such homes; while they will learn self-respect, sterling

independence, and the duty they owe to others as well as to themselves.

If any advance is to be made towards this ideal, I am convinced that education must furnish the chief motive-power, and that no other help you can give to the labourer will be half as effectual as that which awakens and quickens his intelligence, and enables him to help himself. I have shown that the old men employed about a farm practically receive from the farmer small annuities, which are either paid out of profits, or, less probably, represent deductions from their wages when they were young and lusty. Neither hypothesis is satisfactory; and the only sound, healthy system is one under which the young men receive such wages as allow them to save for their own support during old age. County Benefit Societies afford a valuable machinery for securing this end.

But you cannot make bricks without straw, and it is questionable whether, out of his present earnings, the married labourer, however thrifty, can support a family and pay the weekly sum which is necessary to secure for himself an adequate provision in sickness and old age. The first requisite, therefore, is a remuneration for labour which will give an industrious man the means of satisfying these conditions. Piece-work may enable him to do so. At all events, it seems to offer the most promising prospect of reaching this end. I think it is worth a trial: a trial not hastily begun or soon relinquished, but persisted in, even under some discouragement, in the conviction that here is a sound principle, and that some means must exist, and ought to be found, for reducing it to successful practice. I have sought to show that a reciprocal duty is cast upon employers and employed in this matter. We must not look for perfection or forgetfulness of self in either class, and the advantage of the system of labour I have advocated in agriculture is that it appeals to the self-interest of both classes. In day-labour every man should, and a conscientious man does, put forth his strength. But in day-labour a man cannot help feeling that his pay will be the same however he may work. He feels, in short, that he is working for his master, while under task-labour he knows that he is working for himself as well as for his master.

IV.—*On the Composition and Properties of Drinking-Water and Water used for General Purposes.* By Dr. Augustus Voelcker, F.R.S.

Like pure and fresh air, a good and wholesome water is an indispensable element for maintaining the health of man and beast,

and contributing to the comforts of domestic life. It has been surmised that waters which have their origin in crowded cities, or in their immediate neighbourhood, must contain ingredients incompatible with their use as a beverage or for general domestic purposes. The sudden outbreak of cholera, and the prevalence of typhoid fever and other infectious diseases, in certain localities, have long been associated in the popular mind with bad water and impure air; and there can be no doubt of the great influence which the purity of air and water exerts on general health.

In many cases the sudden outbreak of cholera, scarlet and typhoid fever, small-pox, and similar diseases, in particular towns or districts has been clearly traced to the pernicious contamination with sewage of the water used by the inhabitants, or to the infiltration of surface-drainage into the wells which supplied the drinking-water. Most towns in England at present are supplied with wholesome water, which is often brought to the door of the consumer from considerable distances; and the town population in most places is no longer dependent for its water upon local wells and pumps, many of which have been closed altogether by the sanitary authorities. The examination of a large number of samples of water from towns and the country leads me to the conclusion that towns, as a rule, are supplied with purer drinking-water, and water better suited for general household purposes, than country districts, isolated farmhouses, and country residences.

The supply of water in rural districts is often not only deficient in quantity, but frequently largely impregnated with sewage and yard and house drainage, being thus rendered unwholesome, and quite unfit for drinking purposes. There are many villages with no other source of supply than shallow wells; and even the country residences of the nobility and landed proprietors I find frequently are supplied with unwholesome water, or water much less pure than that in use in most towns.

The purity and suitability for general household purposes of spring, river, and well waters, in the first place, are influenced by the chemical composition of the rocks of the locality in which they originate; and in the second place the properties of natural waters are more or less affected by local sources of contamination, such as the proximity of the well to a cesspool, a house or yard drain, a stable-yard or a dung-pit.

If a water emits a strongly disagreeable smell, or if it is more or less coloured yellow, or if it is turbid, or if it shows flocculent, floating particles of organic matter or living organisms, no chemical examination is requisite to prove its unwholesome character and unfitness for drinking purposes. It, however, frequently happens that fairly bright and barely coloured water,

emitting no smell whatever, nevertheless may be impregnated with an amount of organic impurities and certain saline ingredients which will render it unfit for drinking and cooking purposes. By a careful chemical and physical examination it may be decided without much difficulty, in many cases, whether or not water is fit for drinking, and which of a number of samples is best adapted for general domestic purposes. In other instances the analytical indications are less decisive, and the water will have to be pronounced of a suspicious or doubtful, or, at all events, not perfectly wholesome character.

I purpose in the following pages to pass in review the various kinds of natural waters, pointing out their composition, properties, and adaptation for household purposes; next to direct special attention to the sources of contamination which render water more or less unwholesome or unfit for domestic use; and lastly, as far as practicable, to point out any available means for purifying water.

The principal varieties of natural waters are rain-water, spring-, river-, well-, and sea-water. The latter may be dismissed at once, the purport of this paper being to treat of waters which are used for domestic purposes. The remaining varieties may be conveniently placed in two groups, and described as *soft* and *hard* waters. There is, however, no distinct line of demarcation separating the two groups, for the difference between hard and soft waters is one of degree and not of kind. Speaking generally, a water is called soft if it contains per imperial gallon not more than 12 to 15 grains of fixed constituents, the greater part of which consists of carbonate and sulphate of lime and magnesia. If there are more than 8 to 10 grains of lime and magnesia compounds in the total fixed residue, and the amount does not exceed 16 grains, the water is said to be moderately hard; and if the earthy matters exceed 16 grains in the gallon it is considered decidedly hard.

Soft Waters.

Rain-water.—In nature, water is never found perfectly pure. The impurity of the water is frequently visible to the eye. Fine suspended red clay often imparts a reddish colour to rivers flowing through rocks of red marl, which contain much oxide of iron in their composition; occasionally it appears milky, from fine particles of white clay, which settle with difficulty or only imperfectly after long subsidence. In other instances river-water is contaminated with town-sewage and then appears muddy and more or less dark-coloured. It is generally brown where it issues from boggy lakes or passes across a

peaty country, and in that case seldom is perfectly clear and colourless.

Besides the visible impurities taken up from the rocky and other materials which water meets with in and upon the earth, there are others which are held in solution, the presence of which cannot be detected by the sense of sight. The brightest, clearest, and perfectly colourless spring and river waters are never chemically pure; they all contain in solution a greater or less quantity of saline matter and earthy constituents, which are left behind as a fixed residue when the water is evaporated to dryness.

The water which descends as rain, having undergone a species of natural distillation, is, if collected in clean vessels and in the open country, the purest and softest of all natural waters. On evaporation to dryness it scarcely leaves any fixed residue. It is contaminated only with exceedingly small quantities of carbonic and nitric acid and ammonia, and light floating particles of impurities washed by it out of the air during its descent as rain. Rain-water collected in towns or smoky localities, such as manufacturing or coal-mining districts, contains, in addition to the traces of atmospheric impurities just named, soot and other mechanical impurities, or constituents dissolved from the materials of the roofs of the buildings upon which the rain falls. Rain-water collected in towns is always more or less dirty from suspended or mechanical impurities, and generally more or less yellow-coloured by soluble organic matter.

In a filtered state rain-water is the softest natural water, and most useful for washing purposes or for the feeding of steam boilers. It absolutely prevents boiler-incrustations, which cause so much inconvenience, when hard waters, largely impregnated with lime-salts, have to be used in kitchen boilers and steam generators. Rain-water, however, is insipid and wanting in the peculiar refreshing taste so much prized in fresh and bright spring-water. On keeping, moreover, the organic impurities enter into decomposition and impart a disagreeable smell to it, which can only be effectually removed by filtration through a charcoal filter.

In view of the great advantages of having the command of soft water for washing purposes, arrangements should be made in every country house for the collection of rain in suitable reservoirs. The rain-water may be gathered in water-tight cemented brick-tanks, or it may be stored conveniently in wooden tanks or a number of large barrels. But it should not be kept in tanks lined with sheet-lead, which would be rapidly corroded; and as this poisonous metal passes into actual solution in the shape of oxide of lead, rain-water collected in such tanks should on no account be used for drinking purposes.

Lake-waters.—Amongst the purest natural waters hitherto examined are the waters of several lakes in the north of Scotland and of Cumberland. These waters contain only a small proportion of solid matter per gallon; they are very soft in consequence, and excellent for washing purposes. At certain times of the year they get coloured by peaty matters, which, besides rendering them rather unsightly, give them an unpleasant taste. The water of Loch Katrine, which furnishes Glasgow with a copious supply of excellent water, has been repeatedly analysed, at all periods of the year, by different chemists, and has been found exceedingly soft and good for general household purposes. I have myself analysed Loch Katrine water, as well as that of some other Scottish lakes, and, as illustrations of the chemical characters of very soft lake-waters, append the following analyses:—

Composition of Water from Loch Katrine, St. Mary's Loch, and Portmore Loch in Scotland.

	Loch Katrine.	St. Mary's Loch.	Portmore Loch.
	Grains.	Grains.	Grains.
An imperial gallon contains:—			
Organic matter	·80	2·00	·92
Earthy carbonates	·35	·79	1·93
Sulphate of lime	·64	·81	·45
Chloride of sodium	·79	·59	1·01
Nitrate of magnesia	trace	trace	trace
Silica and oxide of iron and alumina	·10	·20	·23
Total fixed constituents in grains per gallon	2·68	4·39	4·54
Degree of hardness:—			
Before boiling	1·3°	1·6°	2·4°
After boiling	1·0°	1·4°	2·0°
These waters further contained per gallon:			
Free (saline) ammonia	·003	·005	·002
Organic (albuminoid) ammonia	·010	·012	·004
Nitric acid	trace	trace	trace

The sample of Loch Katrine water analysed by me, it will be seen, contained only $2\frac{1}{2}$ grains of fixed residue per gallon, and scarcely 1 grain of this residue consisted of carbonate and sulphate of lime. The St. Mary's Loch water was scarcely harder than that of Loch Katrine, but it was impregnated with much more organic matter, which gave it a yellowish colour and a somewhat peaty taste. The total amount of fixed residue in the Portmore Loch water was in round numbers $4\frac{1}{2}$ grains, ·38 of a grain of which consisted of earthy carbonates and sulphates. In

consequence of the larger proportion of lime and magnesia compounds the water of Portmore Loch is somewhat harder than that of Loch Katrine and St. Mary's Loch, but in comparison with ordinary spring and river waters it is extremely soft. All the three samples, practically speaking, contained merely traces of actual and of organic ammonia, showing clearly that the organic matter in these waters is derived from vegetable and not from nitrogenous animal-refuse matters. Had the waters been contaminated with sewage-products or refuse-matters of animal origin, a much larger amount of free and organic ammonia would have been revealed by the chemical analysis.

There is no evidence on record proving peaty matter to affect the health injuriously; it may therefore be assumed that, although the St. Mary's Loch water was decidedly yellow-coloured, and contained comparatively a large amount of soluble organic matter, it was not unwholesome.

Similar in composition and general character are the waters of the lakes of Cumberland and Westmoreland.

Composition of Water from Hawes-Water, Ullswater, and Thirlmere Lakes.

	Hawes-Water Lake.	Ullswater Lake.	Thirlmere Lake.
	Grains.	Grains.	Grains.
Prof. Way found in an imperial gallon :—			
Lime	·50	·81	·42
Magnesia	·18	·20	·14
Soda	·71	·51	·46
Chlorides of sodium and potassium ..	·40	·69	·77
Oxide of iron, silica, &c.	·25	·20	·05
Sulphuric acid	·51	·37	·44
Carbonic acid	·82	1·03	·56
Organic matter	·62	·35	·77
Total fixed constituents in grains	3·99	4·16	3·61
Hardness before boiling	2·0°	2·1°	1·5°
Hardness after boiling	1·8°	2·1°	1·5°
These constituents, according to Way, are probably combined as follows :—			
Carbonate of lime	·90	1·45	·75
Carbonate of magnesia	·36	·42	·29
Carbonate of soda	·56	·40	·20
Sulphate of soda	·90	·65	·78
Chlorides of sodium and potassium ..	·40	·69	·77
Oxide of iron, silica, &c.	·25	·20	·05
Organic matter	·62	·35	·77
Total solid constituents per gallon (in grains)	3·99	4·16	3·61

The entire district draining into the rivers Lowther, Eamont, and Greta, and adjoining the lakes of Hawes-Water, Ullswater, and Thirlmere, is bare hill-pasture, on siliceous, primitive, or igneous rocks; and it possesses all the attributes of a locality from which an enormous amount of water of remarkable purity and softness may be obtained, as the preceding analyses by Professor Way show.

The proportion of organic matter in all these samples is small; and they all likewise contain only a small proportion of fixed constituents per gallon. The waters of these three lakes, practically speaking, are as soft as those of the Scottish lakes analysed by me, and all are admirably suited for the domestic supply of town populations.

River-waters.—Most of the waters in the granite regions of the north of Scotland contain as little as from 4 to 5 grains of fixed constituents in the gallon, and many small mountain-brooks and Scottish rivers contain but little more, as the following average analyses of a large number of samples of water from Scotland made by Dr. Letheby and myself will show:—

Composition of Water from the South Esk and Tweedale Burn.

	South Esk.	Tweedale Burn.
	Grains.	Grains.
An imperial gallon contained:—		
Carbonate of lime	1·43	1 55
Carbonate of magnesia	·97	·64
Sulphate of lime	·98	·42
Chloride of sodium	1·54	1·04
Silica and oxide of iron	·27	·36
Organic matter	·52	1·26
Total solid constituents per gallon in grains	5·71	5·27
Actual or saline ammonia	·005	·002
Organic (albuminoid) ammonia	·009	·005
Degrees of hardness:—		
Before boiling	3·6°	3·6°
After boiling	3·1°	2·4°

Spring-waters.—Excellent pure and soft spring-waters rise in the Green-sand of Surrey. The following analyses are quoted from a Parliamentary Report on the water-supply of the metropolis. The samples were collected in the district of the Hindhead, to the south of Guildford, in Surrey, pretty well defined, which district includes the watershed on all sides of an elevated tract belonging to the Green-sand formation, and known as the Hindhead, over the summit of which the foot-road to Plymouth is carried for several miles.

COMPOSITION OF SURREY WATERS.

	Spring flowing into Sweet Water, Witley.	Critchmere Springs.	Vellwood, near Haslemere.	The Punch-bowl, near the summit of the Hindhead.	Barford Mill-stream.
An imperial gallon contains:—	Grains.	Grains.	Grains.	Grains.	Grains.
Carbonate of lime	..	..	..	..	2·39
Sulphate of lime	1·32	1·07	·86	·59	·40
Silicate of lime	·65	..	·45	1·00	..
Silicate of magnesia	..	..	..	·30	..
Carbonate of magnesia	·43	traces	traces	..	·27
Chloride of sodium	1·14	·88	·87	·74	·94
Sulphate of soda	..	..	·44	·04	..
Chloride of potassium	·31	·26	..	..	·03
Sulphate of potash	..	·03	·40	·09	·20
Silica	·45	1·00	·93	·10	·72
Iron, alumina and phosphates	..	..	..	·02	·08
Organic matter	1·11	·90	1·24	1·30	1·05
Total fixed residue	5·41	4·14	4·19	4·18	6·08
Hardness	1·95°	1·86°	1·86°	2·45	2·70

These waters were bright and pure, and entirely unexceptionable in point of aëration and colour. Their usual temperature when taken up was from 50° to 52°, showing that their sources are deep-seated, and that they preserve the average temperature of the whole year. Their taste betrayed no organic taint, but evinced great purity, although they appeared rather flavourless and somewhat vapid to persons habituated to the use of hard waters.

Well-waters.—Wells sunk in deep sandy soils or in siliceous rocks generally furnish soft waters. The following analyses of two soft well-waters from Hampshire were lately made by me:

Composition of two Soft Well-waters from Hampshire.

An imperial gallon on evaporation to dryness left:—

	No. 1. Grains.		No. 2. Grains.
Solid residue	8·85	....	6·14
In the residue were found:—			
Oxidisable organic matter	·22	....	·33
Lime	1·96	....	1·29
Oxide of iron	..	....	·14
Magnesia	·51	....	·10
Sulphuric acid	·28	....	·15
Chlorine	1·15	....	·82
Nitric acid	3·50	....	1·54
Soluble silica	·12	....	·84
The waters further contained in one gallon:—			
Actual (saline) ammonia	·001	....	·001
Organic ammonia	·003	....	·002

These constituents are probably united together as follows:—

	Grains.		Grains.
Oxidisable organic matter	·22	....	·33
Oxide of iron	..	....	·14
Carbonate of lime	·28	....	·95
Sulphate of lime	·47	....	·25
Nitrate of lime	4·71	....	1·93
Nitrate of magnesia	·55	....	·37
Chloride of sodium	2·50	....	1·35
Soluble silica	·12	....	·84
	8·85	...	6·16

The sample No. 1 was taken from a well 35 feet deep, the soil being sand and siliceous rock. The sample No. 2 was taken from a well 73 feet deep, sunk at a considerable distance from all buildings, through beds of sand and siliceous ironstone. Both samples are good, wholesome, soft-drinking waters, and well suited for general household purposes.

Lead.—Although soft water is greatly preferable to hard for

washing or cooking purposes, or for supplying steam-boilers, it frequently happens that soft spring and lake-waters, especially when much charged with carbonic acid and well aërated, exert a corrosive action upon lead, and become contaminated with soluble lead-compounds. It is true that the amount of oxide of lead dissolved by the action of soft waters upon leaden pipes, or the sheet-lead linings of water-tanks, rarely amounts to more than one part or less in ten millions of the fluid, but although such small quantities of lead probably will not do any positive injury to persons who take the water habitually, even traces of lead are undesirable in potable waters. The popular notion, that all very soft waters act upon lead, I find is not founded on facts; many take up traces of oxide of lead which pass into actual solution, others do not become impregnated with soluble lead-compounds; and as it is not always possible to ascertain beforehand, or even from the analysis of a soft water, whether it is likely or not to act upon lead, it should not be omitted in the examination of a soft water to make a few experiments, and to test practically its effect upon both new and bright, and dull and superficially oxidised sheet-lead. To this end strips of the metal should be immersed in the water in question in such a manner that a portion of the lead remains uncovered by water, and freely exposed to the air. After a week or a fortnight the strips of lead may be withdrawn, and the water be examined, as well as the strips of lead. Should the latter remain bright, and the parts immersed in the water unaltered, and no turbidity or deposit have been caused in the water, the probability will be that the water has not acted upon the lead, and that it contains no appreciable traces of oxide of lead in solution. But should the strips of bright metallic lead have been rendered dull, or covered with a white powder during the experiment; and should a whitish deposit have been produced in the water, it will appear to have exerted a corrosive action upon the lead, and traces of oxide of lead may have actually passed in solution. In either case the water should be passed through white filtering-paper, and the perfectly clear fluid, after having been slightly acidulated with acetic acid, be saturated with sulphuretted hydrogen by passing a current of the gas into it. If there are no traces of lead in the clear and filtered water it will remain unchanged, but should it assume a yellowish-brown colour, the presence of lead will be indicated by the colour, which will be all the more deep and decidedly brown the more lead has passed in solution in the course of the trial.

Most waters which corrode lead usually act more or less energetically upon metallic iron. The storage of soft water in iron

tanks and its conveyance through iron pipes are frequently attended with inconvenience, for the hydrated oxide of iron, produced by the action of the water upon iron, gives a reddish-brown colour to the water, and renders it muddy to an extent which entirely prevents its use for household purposes. With a view to preventing the corrosive action of soft water upon iron, it has been recommended to substitute galvanized iron for plain cast- or sheet-iron. I find, however, that galvanized iron is not an efficient protection against the corrosive action of water; and instances have been brought under my notice in which tanks made of galvanized iron were attacked more rapidly than plain cast-iron tanks. In galvanizing iron it is difficult, if not practicably impossible, to cover the surface of the iron with metallic zinc so completely as not to leave here and there small particles of iron of a rough surface unprotected by zinc; and it appears to me that a true galvanic action is set up by the water in contact with the two metals—iron and zinc forming a galvanic pair—in virtue of which action the iron is more rapidly corroded than in the case of ungalvanized-iron tanks.

As an example of the inconvenience of the storage of soft water in galvanized-iron tanks, and its distribution through iron pipes, I may mention a case which has lately been submitted to me. A gentleman residing in the country wrote to me:—

"I am in a great difficulty as regards the working of a boiler at the back of my kitchen grate. This boiler is connected with a cistern in the upper part of the house, and this cistern is supplied with our lake water by means of a ball-cock.

The boiler and hot-water cistern are connected together by two 2-inch iron pipes, the whole was mounted by one of the first makers in London. The cistern supplies hot water to two baths and to some housemaids' closets. After being at work some eighteen months a very slow delivery of hot water was gradually observed, and finally, on examination, one of the pipes at least (the downward floor) was found to be nearly choked with the material, a sample of which I hand you for examination. This material seems to line the whole of the pipe, even that part which is placed vertically. I should observe that the lower end of the supply-pipe dipping 15 inches into the boiler appears to be corroded and the zinc eaten away from the iron.

"You analysed the water some two or three years ago and pronounced it to be very good. In fact, filtered, we use it now as drinking-water. Nearly the whole of it is drainage water. Will you kindly examine the substance and give me your opinion as to its origin."

On examining the dark-brown material which nearly choked up the supply-pipe, I found the bulk to consist mainly of hydrated oxide of iron, with small quantities of carbonate of lime, silica, and magnesia, some carbonic acid, and traces of sulphuric acid, manganese, and zinc.

The following is its composition, when dried at 212° Fahr.:—

Composition of an Incrustation taken from an Iron Water-pipe.

	Grains.
Water of combination and a little organic matter (loss on heating)	7·93
Oxide of iron	88·89
Carbonate of lime	·18
Silica	·61
Carbonic acid, magnesia, traces of sulphuric acid, manganese, zinc (not determined separately) ..	2·39
	100·00

On further enquiry I learned that the galvanized-iron tank which supplied the water was corroded to a certain extent, and a deposit similar to the material in the pipes was found at the bottom. The composition of the brown incrustation clearly betrayed its origin. It was mainly hydrated oxide of iron, formed by the action of the water upon the galvanized-iron tank. The tank deposit evidently was carried down in the supply-pipe, and gradually choked it up. The pipe itself, although rusty in the interior, did not appear to have been eaten away in any appreciable degree; the substance which choked it could not therefore have been derived entirely from the action of the water upon the pipe, and as the lake-water on analysis was found to contain merely traces of oxide of iron, it could not have given rise to the deposit, which was evidently carried down mechanically from the tank where it was first produced.

Probably the iron supply-pipes would have remained in good working-order for many years but for the iron tank. In order to remedy the inconvenience arising from the storage of soft lake-water in galvanized-iron tanks, I recommended my correspondent to replace the tank by a slate cistern, and have no doubt by this means the supply-pipes will be kept clear from any deposit and in good working-order for years to come.

Hard Water.

Springs rising in granitic regions, or in localities where primitive rocks, little acted upon by water, prevail, or which have their origin in siliceous strata, furnish soft water, we have seen. On the other hand, springs which rise in the oolite or chalk-formation, and all waters which flow over calcareous rocks, or pass through soils abounding in lime, are always more or less largely impregnated with carbonate and sulphate of lime and magnesia. It is chiefly to the lime and magnesia, in combination with carbonic or sulphuric acid, that what are called hard waters owe their property of curdling soap. Perfectly pure or soft water, in

contact with chalk or limestones (carbonate of lime), is capable of dissolving only a very minute quantity of these materials; one gallon of water taking up no more than 2 grains of carbonate of lime. This earthy impregnation is said to give the water 2 degrees of hardness. Most natural waters, however, contain more or less carbonic acid gas, which is a good solvent of carbonate of lime, forming with it soluble bicarbonate of lime.

Spring waters in the chalk-formation often contain as much as 16, or even 20 grains and upwards, of carbonate of lime in the gallon. Such waters are generally bright and sparkling to the eye, and agreeably sweet to the taste. When boiled they become milky, and leave a sediment which incrusts the insides of kettles and boilers. The explanation of the change which hard waters undergo on boiling is found in the fact that the second equivalent of carbonic acid in the soluble bicarbonate of lime is only loosely united with carbonate of lime. At the ordinary average temperature of the air, hard water contains bicarbonate of lime in a state of perfect solution, but on raising the temperature to the boiling-point of water the carbonic acid, which holds the carbonate of lime in solution, is driven off, and insoluble carbonate of lime is then precipitated, as a sediment, in consequence, with the exception of the two grains which are held in solution by the water itself. The carbonate of lime, dissolved by carbonic acid and curable by boiling the water, expresses its *temporary* hardness.

An artificially prepared hard water, containing $13\frac{1}{2}$ grains of carbonate of lime to the gallon, was observed to decrease from 13·5 to 11·2 degrees of hardness merely by heating it in a kettle to the boiling-point. Boiling for 5 minutes reduced the hardness to 6·3 degrees, 15 minutes to 4·4 degrees, 30 minutes to 2·6 degrees, and 1 hour to 2·4 degrees. The softening effect of boiling does not therefore appear all at once, but the greatest proportional effect is certainly produced by the first five minutes' boiling.

In addition to carbonate of lime, hard waters generally contain sulphate of lime and not unfrequently nitrate of lime, and occasionally chloride of calcium. These salts of lime are dissolved in water without the intervention of carbonic acid gas, and therefore remain in solution although the water is boiled, and impart to it *permanent* hardness.

Soft water readily produces a lather with soap; hard water, on the other hand, destroys much soap before a lather is formed. Soap may be regarded as a soluble compound of soda with fatty acids. With lime these fatty acids form insoluble compounds,

and hence it is that hard waters are deprived of lime, or softened at the expense of soap. The carbonate of lime in water decomposes about ten times its weight of soap in washing, and other salts of lime act injuriously upon soap in proportion to the lime they contain. Carbonate of magnesia and other salts of magnesia act upon a solution of soap in a similar manner to lime-salts.

On adding a solution of soap to hard water, white curdy precipitates are produced, and no lather appears until the lime and magnesia in the water are completely thrown down by the soap-solution. The production of lather by the addition of measured quantities of soap-solution of a known strength thus affords a good indication of the degree of the hardness of a water. Each degree of hardness indicates 1 grain of carbonate of lime, or its equivalent of other soap-destroying earthy compounds, in an imperial gallon of water.

The quality of the water-supply as regards hardness varies greatly in different towns, as will be seen by the following Tables:—

Cities and Towns supplied with Water of a Hardness over 10 *degrees.*

	Hardness of Water. °		Hardness of Water. °
Banbury	16·9	Lincoln	11·
Bedford	24·3	London	15·5
Birmingham	15·5	Newcastle and Gateshead	19·5
Bristol	17·1	Norwich	14·5
Canterbury	18·0	Rugby	11·1
Cheltenham	12·0	Runcorn	17·7
Congleton	11·9	Southport	19·5
Croydon	16·4	Sunderland and South Shields	12·6
Deal	18·4	Wakefield	16·
Derby	14·4	Warrington	12·7
Dover	17·	Worthing	17·3
Guildford	18·5	York	14·3
Leamington	18·5		

Hardness of Water-supply from 6 *to* 10 *degrees.*

	Hardness of Water. °		Hardness of Water. °
Accrington	6·9	Liverpool and West Derby	9·6
Ashton-under-Lyne	9·9	Macclesfield	5·9
Birkenhead	8·3	Northampton	7·2
Carlisle	6·1	Northwich	9·8
Durham	7·5	Preston	6·3
Edinburgh	7·	St. Helens	8·9
Leeds	7·5	Wigan	8·4
Leicester	9·4	Worcester	10·
Leith	7·		

Water-supply of a Hardness from 2 to 6 degrees.

	Hardness of Water. °		Hardness of Water. °
Blackburn	4·1	Oldham	4·9
Bolton	3·4	Over Darwen	4·4
Bury and Radliffe	3·8	Paisley	2·9
Churley	3·8	Plymouth	3·
Charlton	2·5	Preston	5·5
Dundee	4·3	Rochdale	3·6
Manchester and Salford	2·5	Stockport	5·8
Maryport	2·3		

Water-supply of a Hardness less than 2 degrees.

	Hardness of Water. °		Hardness of Water. °
Aberdeen	1·4	Lancaster	·6
Cockermouth	1·5	Perth	2·
Glasgow	·6	Sheffield	2·
Greenock	1·3	Whitehaven	1·

The waters supplied by the Metropolitan Water Companies contain from 19 to 24 grains of solid constituents in the gallon, and vary in hardness from 14 to 15 degrees. As an example of a moderately-hard water, the water supplied by the New River Company, London, may be quoted. An imperial gallon of this water contains:—

	Grains.
Earthy carbonates	12·58
Sulphate of lime	2·41
Chloride of sodium	1·28
Nitrate of magnesia	2·08
Silica and oxide of iron and alumina	·38
Oxidisable organic matter	·32
Total solid constituents per gallon	19·05
Degrees of hardness before boiling	14·4°
" " after boiling	4·2°

The water further contains per gallon:—

Actual or saline ammonia	·001
Organic or albuminoid ammonia	·003

Artesian Well-Waters.

Wells sunk in the chalk-formation usually furnish bright, sparkling, perfectly colourless, and excellent-drinking waters, remarkable for their absence of organic impurities. Deep chalk springs, or artesian well-waters, however, are generally hard, and not so well adapted for washing or cooking as for drinking purposes.

The following are the results which I recently obtained in the analyses of two artesian well-waters. No. 1 was obtained from an artesian well sunk in the chalk-formation in Hampshire; No. 2 is water from a deep well in Devonshire. These waters, on evaporation to dryness, left per gallon:—

	No. 1. Grains.	No. 2. Grains.
Solid residue	23·02	25·21
In which we find:—		
Oxidisable organic matter	·22	·30
Lime	9·72	9·72
Magnesia	1·16	·65
Oxide of iron and alumina	·14	·14
Sulphuric acid	·33	·43
Nitric acid	·21	·63
Chlorine	·97	2·87
Soluble silica	1·12	·98
Alkalies and carbonic acid	not determined separately.	
The waters further contained per gallon:—		
Actual (saline) ammonia	none	·001
Organic (albuminoid) ammonia	·004	·002
The hardness before boiling was	$17\frac{3}{4}°$	$16\frac{1}{3}°$
„ after boiling was	4°	$3\frac{1}{2}°$

By uniting the acid with the basic constituents, the composition of the two waters may be expressed as follows:—

Composition of two Artesian Well-waters.

An imperial gallon contained:—

	No. 1. Grains.	No. 2. Grains.
Oxidisable organic matter	·22	·30
Oxide of iron and alumina	·14	·14
Carbonate of lime	16·94	16·59
Sulphate of lime	·56	·73
Nitrate of magnesia	·32	·86
Carbonate of magnesia	2·24	·88
Chloride of sodium	1·48	4·73
Soluble silica	1·12	·98
Total solid constituents	23·02	25·21
Actual (saline) ammonia	none	·001
Organic (albuminoid) ammonia	·004	·002
Hardness before boiling	$17\frac{3}{4}°$	$16\frac{1}{3}°$
„ after boiling	4°	$3\frac{1}{2}°$

It will be seen that both samples contained rather a large proportion of lime, but almost entirely combined with carbonic acid; and sulphate of lime, which gives rise to permanent hardness, was nearly absent. Both waters were softened very fully, as might be expected, by boiling. The original hardness of No. 1

on boiling fell from $17\frac{3}{4}$ degrees to 4 degrees, and that of No. 2 from $16\frac{1}{3}$ to $3\frac{1}{2}$ degrees.

The lime and other saline constituents do not interfere with their use as a beverage. Both were perfectly wholesome and, indeed, choice drinking-waters, for they contained, practically speaking, merely traces of organic matter, and that of a kind which appears to be incapable of undergoing putrefactive decomposition; and their clearness, freedom from colour, and brilliancy, were unexceptionable.

Deep chalk well-water generally has a uniform temperature throughout the year of 50° to 52° Fahr., and thus possesses a desirable coolness which recommends it for drinking purposes. The only and obvious objection to chalk spring-water is its hardness, which, when the water is first drawn, is generally from 16 to nearly 18 degrees. A portion of the carbonate of lime, which occasions the hardness, is deposited from the water, when exposed to the atmosphere, with facility, from the escape of carbonic acid gas, and thus by simple storage in reservoirs or tanks for a few days the water becomes much softer.

The good quality and abundance of the water from the chalk have been proved in every case, and it has been found suitable for town use, as at Gravesend, Folkestone, Dover, Brighton, Lewes, Portsmouth, Deal, Canterbury, Arundel, and Winchester.

When hard waters are used in steam-boilers they rapidly produce a stone-like incrustation or fur, which interferes with the economic generation of steam, and if not removed from time to time may become the cause of boiler explosions. Boiler incrustations produced from hard water consist principally of carbonate and sulphate of lime, as the following analysis, which I made some years ago, will show:—

Composition of a Boiler Incrustation.

	Grains.
Water of combination and organic matter	4·59
Oxide of iron and alumina	·53
Phosphoric acid	·58
Carbonate of lime	71·06
Sulphate of lime	12·75
Lime in a state of silicate	1·56
Magnesia	3·23
Soluble silica	5·70
	100·00

Various plans have been recommended for preventing the formation of boiler deposits, to which reference will be made in a subsequent page of this paper, in discussing the means of effecting the purification of natural waters.

Spring and well waters, in districts where Lias-clay, Wealden, or Oxford clay abound, are sometimes charged with so much saline matter as to give them a decided mineral taste and to impart medicinal properties to them.

A spring of that character occurs in a clay-bed at Purton, near Swindon. This spring is used, with considerable benefit, as a remedy for a variety of disorders; and in addition to the usual constituents of mild saline waters, such as sulphate of soda (Glauber salt), sulphate of magnesia (Epsom salt), and chloride of sodium, the water contains a considerable amount of carbonate of potash, and appreciable proportions of iodide of sodium and bromide of magnesium, which constituents do not occur in ordinary potable waters, and to which, no doubt, its medicinal virtue is partly owing. The alkaline carbonates give it a strong alkaline reaction. An analysis of the saline Purton water, which I made in 1859, yielding the following results in an imperial gallon:—

	Grains.
Water of combination and organic matter (being loss obtained on heating residue, left on evaporation and dried at 320° Fahr.)	8·750
Lime	34·536
Magnesia	25·736
Oxides of iron and alumina, with traces of phosphoric acid	·280
Potash	20·707
Soda	49·006
Chloride of sodium	34·297
Sulphuric acid	165·074
Soluble silica	1·280
Iodine	·056
Bromine	·080
Carbonic acid	33·090
Sulphuretted hydrogen	traces

These constituents arranged into the compound, which probably existed in the water, give the following results:—

	Grains.
Organic matter and water of combination	8·570
Sulphate of soda	112·239
Sulphate of magnesia	77·208
Bromide of magnesium	·092
Iodide of sodium	·066
Chloride of sodium	34·297
Sulphate of lime	83·873
Sulphate of potash	1·916
Carbonate of potash	28·880
Oxides of iron and alumina, with traces of phosphoric acid	·280
Soluble silica	1·280
Solid constituents (dried at 320° Fahr.) per gallon	348·881

The water contained further, free carbonic acid, 23·820 grains in the gallon.

This is a decidedly mineral water. There are other well-waters which possess a less pronounced mineral character, and, for want of better sources of supply, are used for drinking and general domestic purposes. A water of the latter description was lately sent from Norfolk to my laboratory for analysis, and my opinion desired, whether it was a good and wholesome drinking-water.

An imperial gallon, on evaporation, left 146·86 grains of solid residue, dried at 130° Fahr.

In the residue I found by direct determinations:—

	Grains.
Oxidisable organic matter	·34
Oxide of iron	1·06
Alumina and traces of phosphoric acid	·06
Lime	45·23
Magnesia	6·06
Chlorine	8·62
Sulphuric acid	58·93
Soluble silica	·28

Alkalies and carbonic acid not determined separately.

According to these analytical data the composition of the water per imperial gallon may be represented as follows:—

	Grains.
Oxidisable organic matter	·34
Oxide of iron	1·06
Alumina and traces of phosphoric acid	·06
Carbonate of lime	22·27
Sulphate of lime	79·57
Chloride of sodium	14·21
Sulphate of magnesia	18·18
Alkaline carbonates	10·89
Soluble silica	·28
Total solid constituents per gallon	146·86

The water was clear and colourless when first drawn, but on exposure to the air it soon became turbid, and deposited a reddish-brown coloured precipitate, which on examination proved to consist of oxide of iron. The water had a slight inky taste, and a faint smell of sulphuretted hydrogen.

The preceding analysis shows that the water contained as much as 1 grain of oxide of iron in the gallon. The iron occurred in the water combined with carbonic acid, as bicarbonate of protoxide of iron, a compound which, on exposure to the air, parts with carbonic acid and gives rise to the deposition of reddish-brown hydrated oxide of iron. The water owed its peculiar inky taste to this soluble compound of iron.

The water, it will be seen, contained a large amount of sulphate of lime or gypsum, a constituent which renders it permanently

hard. It also contained much carbonate of lime, and about 18 grains of sulphate of magnesia; and, in consequence of the large amount of earthy compounds it was excessively hard, and not suitable for cooking or washing purposes. Although it contained nothing positively injurious to health, it was too largely impregnated with saline matter to be ordinarily used as a beverage, especially as its taste and smell were objectionable.

Properties to be preferred in a Water intended to be used for Drinking and General Household Purposes.

The properties which are esteemed of most value in water for drinking and general domestic purposes are:—

1. Freedom from putrescible organic matter.
2. Freedom from constant, or even occasional discoloration by clay and vegetable matter, with perfect brightness and clearness.
3. Freedom from smell and disagreeable taste.
4. Softness.
5. Coolness.

Water suitable for all domestic purposes should not contain an excess of saline and earthy matters, and, generally speaking, not more than about 25 grains of solid substances in the imperial gallon. The less lime and magnesia salts it contains the better it is for washing, or cooking, or the generation of steam in boilers. A moderate amount of mineral matter, or even a sufficient amount of earthy carbonates to render water decidedly hard, does not interfere with its use as a beverage, for it may be safely stated that no sufficient grounds exist for believing that the mineral contents of ordinary hard spring-water are injurious to health. The amount of lime and magnesian salts in chalk-springs, and in waters having their origin in calcareous strata, must be greatly exceeded in general by the quantity of the same salts which enters the system in solid food; and it is a notorious fact that chalk-springs, which seldom contain less than 15 or 16 grains of carbonate of lime, are universally considered to furnish perfectly wholesome, and indeed the choicest drinking-water. It is true that chalk-springs are wanting in softness, one of the properties most valued in water; but on the other hand, the uniform coolness of the water at all periods of the year, its perfect brightness and clearness, freedom from smell or disagreeable taste, and especially its perfect freedom from organic matter capable of further alteration or decomposition, recommend it as an excellent drinking-water.

In point of softness, the springs in granitic regions, or district

in which primitive rocks prevail, are superior to chalk-springs; but, unfortunately, very soft waters are frequently coloured by organic matter, and, as a rule, act upon leaden pipes more energetically, and are more liable to become contaminated with soluble compounds of lead, than hard waters; and this circumstance presents certain disadvantages to the use of very soft waters, such as those from the Cumberland or Scottish lakes.

In the examination of water, particular attention should be paid to ascertain the quantity of organic matter which a given sample may contain, and also to trace, if possible, the origin of the organic impurities, and to determine whether they proceed from decomposing animal-refuse matters, or from harmless vegetable matter, which is frequently found in lake-waters in peaty localities. Inattention to the discrimination of the kind of the organic matter in a water may lead the analyst to form an erroneous opinion of its true character.

Wholesome and perfectly unobjectionable waters are always bright and free from colour. If a water has a yellowish colour, and at the same time a more or less nauseous taste or smell, no chemical analysis is required to prove its unfitness as a beverage; for such water is certain to contain decomposing organic matter of animal origin, which cannot fail to be a source of serious danger to the health of those who drink it habitually. Light floating particles of suspended organic matter also frequently afford indications of the unwholesome character of water.

It is well, therefore, to submit water to a preliminary examination, upon the result of which it will depend whether it is desirable to incur the expense of a thorough chemical analysis.

In the first place, I would ascertain whether the water is colourless, or more or less tinged yellow. This may be done by filling a glass tube, 2 ft. long and about 1½ in. wide, with the water, placing the tube upon a sheet of white paper, and comparing the colour of the water as seen when looked through the whole length of the tube with the colour of pure distilled water contained in a tube of the same length and diameter. Or the colour may be noted by filling a white Bohemian-glass flask, holding about a quart, and placing it on a sheet of white paper, and placing by its side a flask of the same size, filled with pure distilled water. The best drinking-water appears as colourless as pure distilled water. Most river-waters show a greenish tint; and peaty waters and waters contaminated with yard-drainage or sewage, often appear more or less yellow coloured. By the same experiment the presence of any small floating particles may be readily detected in the water, when the flask is held in front of a dark-coloured wall, a strong light falling on the flask from one side or from above. Should the water contain much

suspended matter, set the flask aside for a couple of days, and then pour off the clear liquid, or pass it through filtering-paper, and examine the colour of the clear or filtered water as before. The suspended matter may be fine clay or marl, and simple filtration or subsidence may render it quite fit for use.

In the next place it should be ascertained whether the water has any smell. If it contains appreciable quantities of sewage or decomposing organic matter, it will necessarily have a bad smell; if there are but small quantities of such matters present, it is often difficult to decide at once whether the water is free from smell or not, and in that case it is best to fill a large flask or bottle with water, to pour out the greater part of the contents, and then to inhale the air in the partially filled flask or bottle. In this way, and especially if the flask is gently warmed, may be detected a disagreeable smell, which cannot be clearly discerned by the ordinary mode of noticing the smell of water.

Another preliminary examination which anyone may make is to fill a clean wine-bottle quite full with water, cork it down tight, and set it aside for about a week; then draw the cork and notice whether the water gives off a bad smell, or has in any other way undergone a change. At the same time place some water in an open vessel—best a clean glass beaker—cover it over loosely with filtering-paper to exclude dust and similar mechanical impurities floating in the air, place the water aside for a week or fortnight, and observe from time to time whether the water remained fairly clear, or whether fungoid growth or the development of plants of the lowest order has taken place. In waters contaminated with even small quantities of sewage the development of vegetable cells and plants of the lowest order is very striking.

Lastly, evaporate about one pint of water in a clean small porcelain dish, or better still, platinum capsule; and notice whether the water remains unaltered as regards colour, or whether it turns yellow or brownish on concentration to a small bulk. If a water contains merely traces of organic matter, it does not sensibly turn colour on concentration; but if it is contaminated with an appreciable amount of organic impurities, it turns yellow or brown. Evaporate the water under examination completely to dryness, and notice the colour of the residue. If quite white, like the residue obtained by evaporating to dryness the colourless water of chalk-springs, no organic matter is present; but if the residue is coloured yellow, as is the case with most natural waters, a certain amount of organic matter is present. The organic matter may be harmless; or it may be injurious to health, and in that case requires further examination which should be entrusted to an experienced and skilled analyst

A good idea of the general character of the organic matter in water may often be formed by noticing the smell which is given off when the residue obtained by evaporating one pint of water is heated over a spirit or gas flame in the dish in which it was obtained, allowing the air free access. Vegetable or peaty matter manifests itself, on heating, by its peculiar smell; and moreover the fumes which are given off, when tested with moistened litmus-paper, show a slight acid reaction. Animal organic matter, on the other hand, on heating, produces fumes which turn reddened litmus-paper blue, and thus have an alkaline reaction; the vapours which are generated when animal organic impurities are exposed to a strong heat possess the peculiar smell, of burned or singed hair or feathers, which characterises all nitrogenous organic matters.

By these simple experiments it may sometimes be decided at once, and without much trouble and in a short time, whether a water is wholesome, or decidedly injurious to health. Other experiments of greater or less value in testing water might be mentioned; but I abstain from doing so, because if the preliminary trials which I have recommended fail to give a decided answer to the inquiry for which they were instituted, the safest plan in that case, for a person who has not had the opportunity of making himself acquainted with analytical processes, is to send the water, on the qualities of which he desires information, to a qualified scientific chemist who has had much experience in the examination of potable waters.

In most instances one gallon will be sufficient for the analysis. The water may be transmitted to the laboratory in a clean and new spirit-jar; but as the jar has to be closed with a cork, and it is desirable to avoid the contact of the water with the organic matter of the cork, the better plan is to send the water in so-called Winchester quarts, which glass-stoppered half-gallon bottles can be bought at about 1*s.* a-piece in any druggist's shop.

Before being charged with the sample of water, the bottles should be filled to overflow with the water, the contents poured away, and again be filled with the same water up to the neck. The glass stopper should then be tied over with a piece of stout clean paper, calico, or leather, and the string sealed, if necessary.

Impurities in Water.

As stated already, in forming an opinion of the sanitary quality of a water, or the merits of a number of samples of potable waters, particular care should be bestowed on the examination of the amount and character of the organic impurities which the water may contain.

In towns, no less than in the country, shallow well-waters are

liable to become contaminated with drainage products containing soluble organic impurities of the most injurious kind to health. In sinking a well, the close proximity of a farmyard or stable-yard, a cesspool or drain conveying house-slops or sewage, or the neighbourhood of a cemetery, or the depositing-place for town-rubbish, and all localities where organic filth accumulates, should be avoided as much as possible; and care should be taken to prevent the infiltration of surface-water into the well, and by making it water-tight, to exclude percolation from drains near or at some distance from the well.

The wells in crowded cities, or the pumps in the close neighbourhood of burial-places, are frequently contaminated with organic impurities of the most objectionable character, and are a frequent cause of the outbreak and spread of infectious diseases. Such waters at certain times of the year are quite bright, free from smell, and scarcely coloured; and their physical properties thus afford no clear indication of anything being wrong with the water. At others they give off a disagreeable smell, and appear decidedly coloured yellow. Well-waters which do not show a uniform character as regards freedom from smell and taste ought not to be used for drinking purposes. In further discussing the peculiarities of unwholesome well-waters, I beg to direct attention to the following analysis which I recently made of pump-water, from a public pump in one of the suburbs of London. On evaporation to dryness, this water left 58·80 grains of solid residue (dried at 130° C.) per gallon.

In the residue I found, by direct determinations:—

	Grains.
Oxidisable organic matter	·56
Lime	13·79
Magnesia	2·22
Sulphuric acid	10·67
Chlorine	8·21
Phosphoric acid	·19
Nitric acid	11·90
Soluble silica	·84

Alkalies and carbonic acid not determined separately.

These constituents were probably united together, as follows:—

	Grains.
Oxidisable organic matter	·56
Phosphate of lime	·42
Sulphate of lime	18·14
Nitrate of lime	8·97
Carbonate of lime	5·41
Nitrate of magnesia	8·21
Chloride of sodium	13·53
Alkaline carbonates	2·72
Soluble silica	·84
Total solid matter per gallon	58·80

The water further contained, per gallon :—

	Grains.
Actual (saline) ammonia	·252
Organic (albuminoid) ammonia	·168
Its hardness before boiling, was	$26\frac{1}{2}°$
„ after boiling „	$24\frac{1}{4}°$

This pump-water, slightly yellow-coloured, on evaporation to a small bulk became more strongly coloured yellow; the residue which was left on final evaporation to dryness had a brownish colour, and on exposure to a strong heat in a platinum dish turned dark, and gave off disagreeable smelling fumes, showing that the water contained a considerable amount of unoxidised organic matter. The direct determination of oxidisable organic matter showed a much larger proportion than ought to be present in a good drinking-water.

It will be noticed that the water contained much more chloride of sodium (common salt) and nitrates of lime and magnesia than is found in wholesome drinking-waters. The proportions of actual and organic (albuminoid) ammonia were likewise greatly in excess of the quantities usually found in unobjectionable water. Nitrates are products resulting from the oxidation of nitrogenous organic or animal matters; and although harmless in themselves, unless they exist in water in excessively large proportion, a considerable amount of nitrates points to a source of contamination which may seriously affect the quality of water.

The simultaneous occurrence in the water of much common salt, nitrates of lime and magnesia, of much saline and organic ammonia, and of oxidisable organic matter, is an unmistakable proof of the presence of sewage or drainage products. It will further be noticed that this water contained nearly half a grain of phosphate of lime in the gallon. Ordinary spring and wholesome well-waters never contain more than mere traces of phosphate of lime; and according to my experience, phosphates are only found in appreciable proportions in waters highly charged with sewage, or products resulting from the decomposition of animal organic matter. The total amount of solid matter was more than twice as large as that found in hard but wholesome waters, and this also showed that something was wrong with this water.

I was afterwards informed that there is a burial-ground in the neighbourhood of the pump from which the water was drawn, and I have no doubt that the drainage of that ground finds its way into the well which supplies the public pump. At any rate, the water was largely impregnated with organic impurities of animal origin, and rendered thereby unwholesome and totally unfit for drinking purposes.

A few months ago several cases of typhoid fever occurred in a

family, and suspicion having been raised with regard to the purity of the drinking-water used by that family, two samples were sent to me for examination. One of the samples was decidedly yellow-coloured, the second nearly colourless. On evaporation to dryness they left respectively, per imperial gallon:—

	No. 1. Grains.		No. 2. Grains.
Solid residue	70·11	....	70·84

In the residue I found, by direct determination:—

Oxidisable organic matter	·23	....	1·56
Oxide of iron and alumina and phosphoric acid	·28	....	·98
Lime	19·91	....	14·79
Magnesia	3·98	....	6·15
Sulphuric acid	9·13	....	12·16
Nitric acid	5·77	....	·14
Chlorine	10·35	....	12·40
Alkalies and carbonic acid, not determined separately.			
Soluble silica	1·12	....	1·40

The two waters further contained in the gallon:—

Actual (saline) ammonia	·014	....	·039
Organic (albuminoid) ammonia	·021	....	·058

According to these analytical data the composition of these two waters may be expressed as follows. An imperial gallon contained:—

	No. 1. Grains.		No. 2. Grains.
Oxidisable organic matter	·23	....	1·56
Oxide of iron and alumina and phosphoric acid	·28	....	·98
Carbonate of lime	24·14	....	11·21
Sulphate of lime	15·52	....	20·67
Carbonate of magnesia	3·86	....	12·81
Nitrate of magnesia	7·91	....	·19
Chloride of sodium	17·05	....	20·44
Alkaline carbonates	..	....	1·58
Soluble silica	1·12	....	1·40
Total solid constituents (dried at 130° C.)	70·11	....	70·84
Actual (saline) ammonia	·014	....	·093
Organic (albuminoid) ammonia	·021	....	·058

In explanation of the preceding analytical results I would observe:—

1. The total amount of solid matter is much larger in both samples than in good drinking-waters.

2. Both contain more actual and organic ammonia than ought to occur in wholesome water.

3. The proportion of oxidisable organic matter in sample No. 1 is inconsiderable, and in sample No. 2 very large.

4. Both samples are largely impregnated with common salt.

5. Sample No. 1 contains a considerable amount of nitrates, and sample No. 2 only traces of nitrates.

It appears from these results that both samples are contaminated with drainage products, which render both unwholesome, and fully account for the outbreak of typhoid fever in the family. Although No. 2 contains only traces of nitrates, it is, nevertheless, the worse of the two samples, for it contains a much larger proportion of unoxidised organic matter, and more ammonia than No. 1; and the organic impurities which found their way into the wells from which the samples were drawn having undergone a more perfect oxidation in No. 1 than in No. 2, exist in the former sample in a less dangerous condition than in the latter. The amount of nitrates in different samples thus must not be regarded as the measure of their relative purity. Fresh sewage or drainings from dung-heaps I find contain no nitrates whatever, and hence the absence of nitrates, or the occurrence of mere traces, does not prove that a water is wholesome. On the contrary, the absence of nitrates, and the simultaneous presence of much unoxidised organic matter, of chloride of sodium (common salt), and appreciable quantities of saline and organic ammonia in a water, show that it is contaminated with the most objectionable and decidedly injurious organic impurities.

These examples might suffice for having directed general attention to the frequent use which is made of unwholesome drinking-water in country districts; and I may observe, that scarcely a week passes in which I do not receive a sample of water from the country which, on analysis, proves to be injurious to health, by being contaminated with imperfectly oxidised drainage products. I cannot refrain, however, from directing attention to one additional case in point, which has quite recently been brought under my notice. A gentleman residing in Lincolnshire recently lost two beasts. The veterinary surgeon who was consulted was unable to account satisfactorily for the cause of the death of the animals, but thought it probable that the water given to them may have contained something injurious to health, or have been deficient in some important element. A sample of the water was consequently sent to me, and my opinion was solicited as to the effect the water was likely to have had on the deceased beasts. The water in question was coloured slightly yellow, and contained some light floating particles of matter of apparently organic origin, but it was free from smell. The residue which was left on evaporation was

yellow-coloured, and turned dark on exposure to a strong heat in a platinum dish. The residue amounted to 218·26 grains per gallon, and in it I found by direct determinations:—

	Grains.
Oxidisable organic matter	2·68
Oxide of iron aud alumina	·95
Phosphoric acid	·17
Lime	39·82
Magnesia	15·49
Sulphuric acid	82·34
Nitric acid	10·50
Chlorine	27·52
Soluble silica	1·82
Alkalies and carbonic acid, not determined separately.	

The water further contained in the gallon:—

Actual (saline) ammonia	·126
Organic (albuminoid) ammonia	·126

According to these analytical data the composition of the water may be represented as follows:—

An imperial gallon contained:—

	Grains.
Oxidisable organic matter	2·68
Oxide of iron aluminа	·95
Phosphoric acid	·17
Sulphate of lime	96·71
Sulphate of magnesia	34·83
Nitrate of magnesia	13·93
Sulphate of soda	3·96
Chloride of sodium	45·35
Alkaline carbonates	17·86
Soluble silica	1·82
Total solid constituents per gallon	218·26
Actual (saline) ammonia	·126
Organic (albuminoid) ammonia	·126

A cursory inspection of these results will show that the water was impregnated with no less than 218 grains of earthy and saline matters per gallon, comprising nearly 100 grains of sulphate of lime, about 45 grains of common salt, much sulphate of magnesia, a considerable proportion of nitrate of magnesia, and other saline compounds. Besides the saline and earthy impurities which were present in abnormally large proportions, the water was contaminated with much unoxidised organic matter. The occurrence in the water of nitrates, and much more saline and albuminoid ammonia than is ever found in good drinking-water, clearly showed that the organic impurities were derived from animal refuse-matters. Unquestionably the water was charged with a large proportion of injurious organic impurities, and much contaminated with saline and earthy compounds, which

were derived from yard-drainage, sewage, or similar objectionable liquids. In consequence of these impurities the water was positively poisonous, and probably caused the death of the two beasts.

Very soft waters, as mentioned already, not unfrequently contain traces of lead in solution. It may be questioned whether minute traces of oxide of lead exert a positively injurious effect upon health, but there can be no doubt that an appreciable quantity of soluble lead-compounds in water affects injuriously the health of man and beast. A remarkable instance of water contaminated with an unusually large proportion of oxide of lead was brought under my notice some years ago. This water on examination was found to contain in the imperial gallon:—

	Grains.
Organic matter	5·22
Oxide of iron	·20
Oxide of lead	·47
Sulphate of lime	3·14
Carbonate of lime	1·31
Magnesia	1·28
Chloride of sodium	2·30
Alkaline nitrates	2·38
Soluble silica	1·05
Total solid matter (dried at 130° C.) per gallon	17·35

It will be seen that this water contained nearly half a grain of oxide of lead in the gallon; and I ascertained that this poisonous oxide occurred in solution partly as bicarbonate of lead, partly as nitrate of lead. The water was drawn from the leaden supply-pipes connected with a well sunk in close proximity to a manure-heap, which accounts for the abnormally large quantity of soluble organic matter in the water. Drainage from the dung-heap evidently passed into the soft well-water, partly in an unaltered condition, partly oxidised into nitrates, which, in contact with metallic lead, are known to give rise to soluble nitrate of lead. Probably the soluble organic impurities in the water also acted upon the lead and gave rise to soluble lead-compounds. The unfavourable position of the well in this case fully accounts for the contamination of the water with injurious organic impurities, and the still more poisonous lead-compounds.

The properties of water, which enable it to act at times with unusual vigour upon lead, are little understood, and seem often to arise from the accidental action of local causes, such as the presence of drainings from dung-heaps and decaying organic impurities. These causes are of a kind most to be dreaded in the supply of a single residence, in which, as in the case before us, the whole volume of water may at a time assume the same

dangerous composition. The facility with which nitrogenous organic matters are oxidised in porous soils and converted into nitrates, adds to the danger of water becoming impregnated with poisonous soluble compounds of lead, for, according to the uniform experience of all chemists who have studied the action of the different constituents of natural waters, no saline matter corrodes lead so readily as nitrates.

Most soft waters act more or less energetically upon lead when they are well aërated and impregnated with atmospheric oxygen, which appears to be a primary cause of the action of soft water upon lead, for pure, distilled, or rain water, purposely deprived of air, does not attack lead in any appreciable degree.

This explains why some soft waters in contact with lead become impregnated with this poisonous metal, whilst others scarcely attack lead, and may with safety be conveyed through leaden delivering-pipes. Hard waters, as a rule, do not act upon lead so readily as soft, especially if they contain carbonate of lime dissolved in carbonic acid gas. The effect of this compound is fortunately to neutralise to an extraordinary degree the usual solvent action on lead which water exercises through the agency of the oxygen dissolved in it. The soluble oxide of lead is converted into carbonate, which, although not absolutely insoluble, appears to be the least soluble of all the salts of lead.

Carbonic acid is usually present in moderately hard spring, river, and well-waters, and also in most soft natural waters, in sufficient quantity to prevent the solution of a dangerous amount of lead.

On the other hand, certain salts, especially sulphates to which a protecting effect is usually ascribed, do not appear to exercise uniformly that useful property. Hard waters containing an abundance of so-called protecting salts, sometimes corrode lead with remarkable rapidity, but, fortunately, no lead passes into solution, for the carbonate of lead resulting from this corrosive action is wholly insoluble, even in water highly charged with carbonic acid gas. Even excessively hard waters sometimes rapidly corrode leaden pipes, especially if they have an alkaline reaction. I have in my collection pieces of originally stout leaden pipes, which in the course of less than twelve months were eaten away to a layer as thin as writing paper, surrounded by a thick hard coating of carbonate of lead. Although carbonate of lead cannot pass into solution, this dangerous lead-compound may be present in water in a suspended state, and in that condition may be mechanically introduced to the system. The practice of filtering water kept in leaden cisterns, and intended for drinking purposes, cannot, therefore, be too strongly recommended.

Purification of Water.

Spring, river, well, or lake-waters, as it has been shown, are rendered impure to a greater or less extent—

1. By suspended animal and organic substances, such as finely-divided clay, marl, flaky organic matters, decaying vegetable matter, and similar mechanical impurities:
2. By soluble organic impurities, which generally colour the water yellow or brownish : and
3. By certain saline matters and soluble earthy compounds, which, in the shape of a more or less considerable and generally slightly coloured residue, are left behind when a measured quantity of any kind of natural water is evaporated to dryness.

In other words, suspended—or mechanical, organic, and mineral,—and soluble—vegetable, and animal,—matters, are the ordinary impurities of natural waters, to which have to be added, in exceptional cases, sulphuretted hydrogen, traces of copper, arsenic, or more frequently lead.

The means available for the purification of water are :—

1. Distillation.
2. Filtration.
3. Precipitative processes, which remove certain soluble earthy compounds.

1. *Distillation.*—When river, or spring, or sea-water, is kept boiling in a glass retort or metal still, it is converted into steam, which carries with it all the gaseous or volatile impurities that may have been present in the natural water, and leaves the whole of the solid saline and earthy matter behind. By suitable cooling apparatus the steam is readily condensed ; and if the first part of the distillate, containing most of the volatile impurities, is rejected, nearly pure distilled water is obtained. Except at sea, or for chemical use, this method of purification is seldom resorted to for effecting the purification of water.

2. *Filtration.*—On a large scale turbid river-water is effectually clarified by passing it through gravel and sand filter-beds. By this means the mechanical impurities, such as fine clay or marl, dead leaves, and similar accidental impurities, are arrested in the filter-beds, and the water is rendered bright. Filtration through sand also removes to some extent soluble organic matters, which sometimes give a yellowish tint to river-waters, for by passing through gravel or sand, a portion of such organic matters is oxidised, and the filtered water is in a measure deprived of the original yellow tint. The saline and earthy matters dissolved

in water, however, are not diminished by sand filtration, or only in a very slight degree. The necessity for this process may be greatly diminished by the use of subsiding reservoirs, which, moreover, have the advantage of exposing the remaining water for a length of time to the oxidising influence of atmospheric oxygen, whereby it is deprived of some objectionable colouring matter. But filtration cannot be entirely superseded, being indispensable as the concluding operation of purification, to remove accidental impurities which may find access to the water, as well as fine particles of clay after remaining for a long time in suspension.

For household purposes, turbid and slightly-coloured water may be made bright and almost colourless by the use of the tank or hand-filters, which are now supplied in all sizes by the London Water-purifying Company, Strand; by Messrs. Atkins, Fleet Street; Mr. Lipscombe, Temple Bar; and other makers of water-filters. In most of the tank and hand-filters advantage is taken of the well-known property of animal charcoal to remove colouring matters. Vegetable or animal charcoal, moreover, retains effectually every trace of lead which a water may contain, either in solution or in a suspended state, and thus tank or hand-filters, in which charcoal is employed as a purifying agent, afford the greatest security against danger arising from the presence of lead poison.

In Spencer's Magnetic Carbide Filter, the purifying agent employed is magnetic oxide of iron mixed with carbon. Mr. Thomas Spencer prepares this material by using Cumberland hematite iron-ore with a certain proportion of carbon, and heating the mixture to a dull red heat in retorts for 24 hours. The porous magnetic oxide produced is mixed with coarse sand when used for filtering water, and it removes effectually all organic impurities in a state of putrescence, and any traces of lead that may be present.

The most recent invention in water-filters has been made by Professor Bischoff, who employs spongy iron as a purifying agent. Bischoff has experimentally investigated the properties of spongy iron, and, amongst other particulars, found that the organic nitrogen and albuminoid ammonia in water are always much reduced in quantity by filtration through spongy iron, which also diminishes the amount of organic carbon. Filtration through spongy iron thus appears capable of decomposing organic matter. It further removes entirely every trace of lead, and, consequently, is a valuable purifying agent for water.

Domestic water-filters, on Professor Bischoff's plan, are made by Messrs. Murray & Co., of the Caledonian Pottery, Rutherglen. The spongy iron through which the water is filtered is contained in a stoneware vessel, with a slightly curved bottom.

On the top of the bottom is a perforated disc, on which the spongy iron is placed. An opening in the curved bottom is connected with an earthenware pipe, which passes up to the outer side of the vessel to slightly above the level of the spongy iron. Here the pipe communicates with another pipe, passing from the top of the outside of the spongy iron vessel down to the centre of the closed bottom. The latter pipe is open at the top and bottom. An alternate exposure to air and water causes the spongy iron to become oxidised, when it loses more or less its purifying power. A screw-tap at the lower end of the latter pipe serves to regulate the flow of the water through the spongy iron. The spongy iron vessel is placed inside the casing of an ordinary stoneware filter, with perforated bottom, beneath which there is a reservoir for the filtered water. On the top of the perforated bottom is placed a layer, some four inches thick, of finely-divided marble or limestone, upon which the water containing some iron in solution flows from the screw-tap. The effect of the limestone is to remove completely every trace of iron from the water.

Bischoff's filter has a decided advantage over ordinary water-filters, which soon lose their purifying properties unless the filtering agent is renewed from time to time, whereas Bischoff's filter remains in good working order for years, without requiring the renewal of the spongy iron.

3. *Purification of Water by Precipitating Processes.*—An elegant and useful process for softening hard water is that patented by the late Dr. Clark, of Aberdeen. Carbonate of lime is scarcely soluble in pure distilled water, a gallon being capable of holding only about 2 grains in solution. In river or spring-water, however, carbonate of lime is held in solution by carbonic acid, or, in other words, exists as bicarbonate of lime. On boiling, the second equivalent of carbonic acid in the soluble bicarbonate is expelled, and neutral carbonate of lime precipitated. Professor Clark proposed to soften hard water by taking advantage of the property of caustic lime to remove carbonic acid from water. Caustic lime, when added to hard water in sufficient quantity, neutralizes the carbonic acid, removes the solvent, and, becoming at the same time carbonate of lime, is precipitated with that originally in solution. In falling down, the precipitated carbonate of lime carries with it a portion of the organic and colouring matter present in most waters, and thus Clark's process not only softens, but in a measure also deprives hard water of organic impurities.

Clark's process is peculiarly well adapted to the softening of chalk springs, which owe their hardness almost entirely to carbonate and not to sulphate of lime, a constituent which cannot

be removed by heating as by the lime process, and which renders water permanently hard.

The composition of spring or well-water from the chalk-strata varies but little in different localities. Its hardness rarely exceeds 18 degrees, and pretty uniformly amounts to from 16 to 17½ degrees. Water of that degree of hardness contains in 400 gallons about 1 lb. of carbonate of lime, held in solution by 7 ounces of carbonic acid gas. 1 lb. of carbonate of lime, in round numbers, consists of 9 ounces of caustic lime and 7 ounces of carbonic acid. It is evident, therefore, that the addition of 9 ounces of caustic or quicklime to 400 gallons of such water will have the effect of depriving it of the 7 ounces of carbonic acid gas, which holds 1 lb. of carbonate of lime in solution; and that both the lime added and that originally present must be precipitated together as neutral insoluble carbonate of lime, minus a small quantity, amounting to about 2 grains in the gallon, which pure water is capable of dissolving.

The original hardness of chalk springs may thus readily be reduced by Clark's lime-process from 16 to 18 degrees to from 2 to 4 degrees.

This process is sufficiently simple to be left to the execution of a workman of ordinary intelligence. All that is required for him to do is to stir lime-water or milk of lime, made by mixing quicklime with water—about 1 lb. to 40 gallons of water—into the water intended to be softened, until the carbonic acid which holds the carbonate of lime in solution is completely neutralized by the addition of quicklime. The spring-water, on the addition of the lime-water, at first has the appearance of thin milk, but the preciptation of the carbonate of lime proceeds with rapidity, and in the course of 24 hours the water may be syphoned off from the precipitate and received in a perfectly clear condition into the supply cistern or tank. The only precaution necessary to be taken is to insure the absence of an excess of lime. To this end the water in the settling tank has to be tested from time to time with a few drops of a weak solution of nitrate of silver. This test gives a white precipitate in the original hard spring-water, and shows whether the quantity of lime required has been exceeded, by the brown colour of the precipitate then formed. In practice the addition of lime-water is stopped as soon as a sample of the filtered water from the settling tank gives a brownish-coloured precipitate with the nitrate of silver test. In that case more of the hard water is added, and well mixed with the contents of the settling tank. After subsidence, a sample of the softened water is again tested with a drop or two of a nitrate of silver solution, and the addition of more hard water if necessary is repeated a third time, or until the

water ceases to give a brown colour, and yields a white-coloured precipitate with nitrate of silver.

Clark's process has been tried on a large scale, and is in successful operation in many dye-works and other manufactories, where large quantities of soft water are required. The water used by railway companies for feeding their engines is also softened in several places by this useful and extremely simple process; and by it the Water Works Company, at Caterham, has for some years past rendered hard chalk spring-water deliciously soft and pure before delivering it to the inhabitants of Caterham. The only drawback in working this process on an extensive scale is the difficulty of finding space for precipitating reservoirs, and storing for an additional 24 hours the immense volume of water which is required for the supply of large cities. However, this difficulty after all resolves itself into a question of expense, which is of no account in the case of private houses, in which Clark's process can be carried out very well without much difficulty.

In conclusion, a few lines on the prevention of boiler incrustations may be considered serviceable.

Ordinary boiler incrustations, resulting from the use of hard water, consist chiefly of carbonate and sulphate of lime, as will be seen by the following analysis of a sample which I examined some time ago:—

Composition of a Boiler Incrustation.

	Dried at 212°. Grains.
Water of combination	4·59
Oxide of iron	·53
Phosphoric acid	·58
Carbonate of lime	71·06
Sulphate of lime	12·75
Lime in a state of silicate	1·56
Magnesia in a state of silicate	3·23
Soluble silica	5·70
	100·00

Carbonate of lime separates gradually from hard water when the temperature is raised to the boiling-point, and in the course of time assumes a crystalline form. Hard crystalline masses or stone-like deposits are thus formed in steam-boilers, which greatly interfere with the economical production of steam.

The best plan of preventing the formation of boiler-deposits like the sample, the analysis of which has been given, is to soften the water by Clark's lime-process.

The next best plan, in my judgment, is to add to the water a solution of caustic soda; to allow the precipitate to settle, and to use the clear water for feeding the boiler.

Or if it be considered too much trouble to soften the water in

this way, caustic soda dissolved in water may be put into the steam-boiler. By this means the precipitation of carbonate of lime, as well as the removal of lime from sulphate, is effected in a condition in which the lime to precipitate is far less crystalline than it is when no precipitating agent is employed.

The formation of crystalline and hard incrustations in boilers may also be prevented to a great extent by placing in the boiler potato-peelings, spent-tan, peat-mould, coarse sawdust, or chips of oak-wood and bark, or similar materials, which act in a purely mechanical manner in preventing the agglomeration of crystalline particles of carbonate of lime into hard masses. Several compositions sold as preventives of boiler incrustations act mainly in a mechanical way, and others partly chemically and partly mechanically. A favourite composition, sold under various names, consists of a combination of crude tannic acid, produced from gum catechu or oak-bark, or other astringent raw materials, with bone-gelatine or glue. Crude tannic acid and caustic soda are likewise constituents of several fluids recommended as preventives of boiler-deposits.

11, *Salisbury Square, Fleet Street, E.C., January*, 1875.

V.—*Report on the Agriculture of Sweden and Norway.* By H. M. Jenkins, F.G.S., Secretary of the Society.

General Contents.

Introduction.

The agriculture of the Scandinavian Peninsula is less known to Englishmen than that of any other region of Northern Europe. The farming of the more distant empire of Russia has

received greater attention on account of that country having been the source from which the rinderpest has more than once come to us of late years, and also because it is the chief European granary to which the English consumer looks for supplies of wheat after a deficient harvest at home. Special features in the land-laws, the rural economy, or the methods of farming of other countries have attracted the attention of political economists and writers on agriculture; but, so far as I know, the agriculture of Sweden and Norway has not hitherto been described.

Within the last few years the question of the supply of meat to large towns has directed public attention in a marked degree to the more sparsely populated countries, whence supplies of cattle might be obtained at a price that would admit of their profitable importation into Great Britain. Again, in Sweden and Norway cottages are generally built of wood, and the recent extension of the cut-wood trade with those countries (see Tables I. and II.) led to the belief that imported wooden cottages for agricultural labourers might be erected in England more economically than with the usual materials of brick, stone, or concrete; but the results of careful inquiries on this subject did not confirm this impression, and the experiments made have not been reduced to practice on a large scale.

The statistics of the trade between the United Kingdom and Sweden and Norway are published annually in the Board of Trade Returns, and the following Tables (p. 164), culled from that source, show the progressive development of our import trade in cattle and other agricultural products from those countries during the five years, 1869–73.

The total value of the imports from Sweden rose from 4,498,384*l.* in 1869, to 7,739,744*l.* in 1873, showing an increase of over 70 per cent.; and the total value of the imports from Norway rose from 1,855,161*l.* in 1869, to 2,947,033*l.* in 1873, or an increase of 60 per cent. In the case of Sweden, the value of the timber is about one-half, and in that of Norway about two-thirds, the total value of all the imports into the United Kingdom from those countries.

Our imports of cattle and wood from Sweden and Norway have thus been recently increasing, and their importance is well shown in the following Tables. But the significance of our exports of live stock to those countries, though they also are increasing in quantity and value, cannot be so well delineated in a table of figures, for as mere units they appear insignificant. Their real importance lies in the fact that the animals go into Scandinavia for the purpose of improving the indigenous breeds, and thus largely contributing, not only to the greater weight of

TABLE I.—IMPORTS OF AGRICULTURAL COMMODITIES FROM SWEDEN IN THE YEARS 1869–73.

	Weights or Measures.	1869.	1870.	1871.	1872.	1873.
Animals: Oxen and Bulls	No.	3,059	4,156	4,791	4,955	8,600
,, Cows and Calves	,,	306	588	824	2,118	3,603
Butter	Cwts.	2,271	10,043	20,543	19,881	23,126
Corn: Wheat	,,	62,888	36,852	19,289	44,566	34,058
,, Barley	,,	192,315	414,187	356,567	357,941	182,004
,, Oats	,,	2,671,688	4,485,744	3,695,004	4,823,713	3,958,647
,, Other kinds	,,	1,285	29,947	58,548	13,156	6,494
Oil-seed Cake	Tons.	1,307	2,184	1,720	2,539	2,893
Wood and Timber, hewn	Loads.	180,346	253,365	231,760	274,855	366,455
,, ,, sawn or slit	,,	733,150	962,262	974,408	1,013,108	1,033,682

TABLE II.—IMPORTS OF AGRICULTURAL COMMODITIES FROM NORWAY IN THE YEARS 1869–73.

	Weights or Measures.	1869.	1870.	1871.	1872.	1873.
Animals: Oxen and Bulls	No.	61	..	700	857	1,513
,, Cows and Calves	,,	..	2	319	597	705
Butter	Cwts.	3,754	1,935	5,375	2,630	2,131
Corn: Oats	,,	81,000	147,438	182,459	224,817	219,643
Oil-seed Cake	Tons.	1,723	2,812	3,005	2,360	2,959
Wood and Timber, hewn	Loads.	134,591	173,978	231,592	236,121	335,825
,, ,, sawn or slit	,,	483,559	560,062	520,396	510,368	502,200

the individual beasts which are imported into Great Britain for slaughter, but also to the increased production of milk, which has rendered possible the increase of exports of dairy produce to Great Britain and other countries.

The following Tables (III. and IV., pp. 166, 167) give the actual imports and exports of agricultural commodities, so far as Sweden is concerned, for the five years, 1869-73 inclusive; the returns for the last year being, however, somewhat incomplete.

At the present time the agriculture and commerce of Sweden are progressing with a rapidity that is probably not excelled in any other European country. The railway system has within the last few years been greatly extended, and new railways are still being opened for traffic at frequent intervals.* The maps and guide-books published three years ago are now out of date, and those which at this moment may be in the press will in a year or two be considered behind the time. New markets for his produce have thus been brought within the reach of the Swedish farmer, and at the same time he has been enabled to compare his modes of procedure with those followed by his compatriots who have longer possessed foreign customers.

The Government has done its share in the promotion of the agricultural interests of the country, not only by the construction of railways, as just mentioned, but also by the establishment of agricultural schools and colleges, the endowment of agricultural societies in each province of the kingdom, and even by the immediate supervision of the cattle trade, with a view to guaranteeing the exporter against loss and the importer against disease.

In the course of this Report I shall endeavour to make clear the relations which exist in Sweden and Norway between the State and the agricultural interest. At present it is sufficient to indicate that the enormous advances that have been made, and are still being made, in these northern countries, though aided and even stimulated by the recent high prices of meat, butter, and wood, could not have been accomplished so surely and so rapidly if the Government had not sent men of mark to explore the new territory; and if they had not in some cases, through the medium of the agricultural societies, organised a system of guarantee, which alone would overcome the distrust of the Scandinavian peasant, and his consequent disinclination to enter upon a path to which he was not accustomed.

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* In a recent communication to the *Pall Mall Gazette* (January 25, 1875), the Acting Consul for Sweden and Norway stated that—"Railways of the length of nearly 1000 miles have been built in Sweden by the State on borrowed money, and as these lines in 1873, the last for which accounts are published, gave a net revenue of 5¼ per cent. on the cost of construction, the operation may even financially be looked upon as successful, though that was not considered when the outlays were voted."

TABLE III.—IMPORTS OF AGRICULTURAL COMMODITIES INTO SWEDEN IN THE YEARS 1869–73.

ARTICLES.	Weights or Measures.*	1869.	1870.	1871.	1872.	1873.
Bacon and Pork	Cent^r.	26,155	31,443	84,020	130,126	238,41
Guano	,,	54,535	121,715	243,202	404,933	
Hemp	,,	33,816	45,436	45,927	47,321	
Hops	,,	3,451	9,839	4,096	5,808	
Horses	No.	721	1,373	1,825	1,871	1,58
Cattle	,,	631	518	177	207	25
Sheep	,,	291	370	352	41	4
Pigs	,,	420	925	2,489	2,649	2,76
Meat	Cent^r.	10,412	12,111	13,657	14,182	18,26
Flax	,,	7,582	16,875	5,362	8,186	
Cheese	,,	8,358	7,933	4,867	9,660	10,5
Butter	,,	32,307	47,400	41,314	37,039	31,5
Unground Corn:—						
Wheat	Cbf.	262,463	247,821	98,734	22,465	68,8
Damaged cargoes	Rd.	4,546	..	7,542	17,571	
Barley and Malt ..	Cbf.	370,927	120,452	70,584	133,924	216,5
Rye	,,	3,942,051	1,065,202	531,344	2,016,048	2,343,8
Damaged cargoes	Rd.	6,049	1,419	..	115	
Vetches	Cbf.	21,331	2,954	2,603	10,341	
Peas	,,	149,786	43,301	3,989	19,856	
Other grain	,,	45,374	63,001	8,924	21,235	
Ground Corn :—						
Grits	Cent^r.	4,633	2,051	1,084	3,605	
Wheat-meal	,,	320,660	248,775	140,916	270,207	328,7
Rye-meal	,,	665,925	547,891	297,499	452,585	743,1
Other kinds of Meal	,,	10,690	11,111	1,465	2,727	
Oilcakes	,,	31,905	31,992	77,698	155,912	
Seeds, except Canary ..	lbs.	1,893,870	2,108,204	1,786,444	3,637,295	
	Cbf.	126,743	261,061	255,884	297,287	

* A centner (100 Swedish lbs.) is about 93 lbs. avoirdupois, and a cubic foot is equa[l to] about 5¾ gallons. Rd. signifies Rigsdaler (= 1*s.* 1½*d.*)

ABLE IV.—EXPORTS OF AGRICULTURAL COMMODITIES FROM SWEDEN IN THE YEARS 1869–73.

ARTICLES.	Weights or Measures.	1869.	1870.	1871.	1872.	1873.
B n and Pork ..	Centr.	1,842	2,783	3,225	2,360	7,121
Se s	Cbf.	34,043	54,673	24,049	6,881	
	lbs.	400,177	518,700	389,613	215,250	
H es	No.	1,395	811	1,024	3,227	3,672
C le..	,,	14,583	13,506	14,276	16,884	26,006
S p	,,	8,476	8,930	17,137	18,208	14,956
P	,,	10,749	16,832	11,537	24,527	20,001
M t	Centr.	1,854	2,045	2,089	2,764	3,925
O ake	,,	30,810	59,540	48,656	61,203	
C ese	,,	2,279	3,985	5,098	5,274	4,339
E ter	,,	28,155	54,679	68,321	85,044	69,922
ground Corn:—						
ats	Cbf.	11,155,606	20,161,920	20,224,108	16,794,829	16,535,620
heat	,,	263,470	484,454	560,342	311,578	400,316
arley and Malt ..	,,	1,426,819	2,552,728	2,491,167	2,219,063	1,695,642
ye	,,	46,176	539,670	598,549	106,063	189,320
ares	,,	189	5,785	3,856	569	
eas	,,	6,875	76,832	221,142	62,026	
ixture	,,	..	2,456	8,590	..	
und Corn:—						
rits	Centr.	708	3,234	2,013	2,862	
at & Barley-meal	,,	35	4,931	1,379	3,741	
heat-meal	,,	12,281	25,473	55,246	55,465	59,200
ye-meal	,,	330	14,489	16,364	9,140	7,276

In view of the increasing importance of the agricultural relations which I have thus endeavoured to indicate, and in the absence of any reliable information in the English language on the present state of agriculture in Sweden and Norway, the Council of the Society resolved that a Report upon the Agriculture of Scandinavia, with special reference to the stock-farming, should be obtained for publication in the 'Journal.' Having been entrusted with the preparation of this Report, which was to include a notice of the Agriculture of Denmark, I spent ten weeks of the past summer in visiting the best districts of Sweden, Denmark, and Schleswig-Holstein, and in taking a rapid glance at the agriculture of Southern Norway.

In the following pages I shall endeavour to give a fair idea of the leading features in the agriculture of the southern provinces of Sweden and Norway, leaving the Report on Danish farming for a future number of the 'Journal.' I have selected this order of proceeding because Danish agriculture has already been twice reported upon in the pages of this Journal,* whereas some short notes on Sweden, published thirty-two years ago,† comprise the only notice of the agriculture of the Scandinavian Peninsula which is contained in the publications of the Royal Agricultural Society of England.

I should be ungrateful if I did not thankfully acknowledge the great kindness and hospitality of all the gentlemen whose names are mentioned in this Report, and of many other worthy representatives of their country; more particularly if I did not specially record the exertions on my behalf of our honorary member, Mr. Juhlin Dannfelt, who took every means and opportunity to further the object of my visit to Sweden; and of the Chamberlain Holst, who did everything in his power to render my brief visit to Norway as instructive and agreeable as possible. I wish also to express my thanks to Mr. Willerding (the Consul-General for Sweden and Norway in London) and to the Acting Consul (Mr. Cöster) for their very great kindness in procuring me official data for statistical calculations, and in giving me any other aid that I required.

Physical Features.

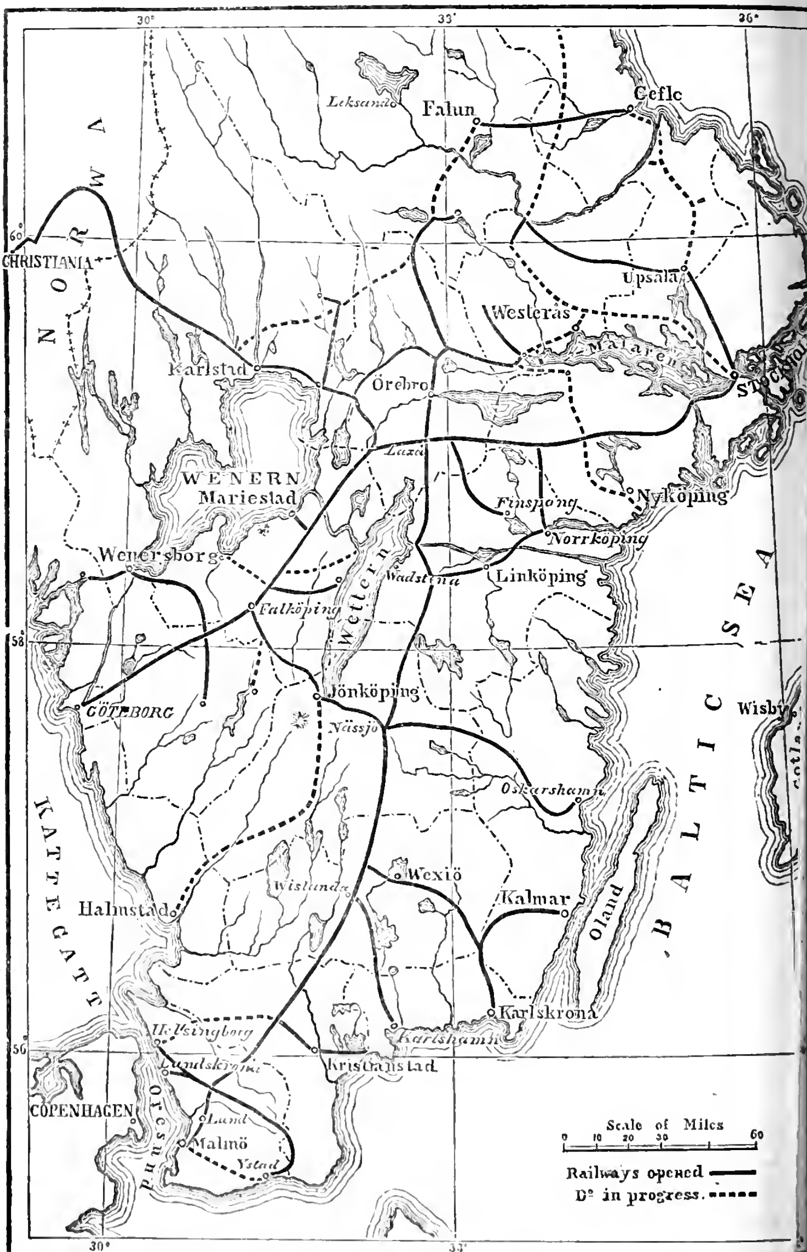
The Scandinavian Peninsula extends northwards from lat. 55° 22′ N. to the North Cape, in lat. 71° 12′ N. Its most southern extremity is nearly in the same parallel as the Tweed, and its chief southern town, Malmö, approximately coincides in latitude with the town of Berwick. The western and extreme

* Vol. ii., 1842, p. 400; and vol. xxi., 1860, p. 267. † Vol. iv., 1843, p. 196.

northern portion of this peninsula is the narrow and mountainous country of Norway, while Sweden forms the larger and less elevated eastern and southern division. Though both countries are under the same Sovereign, each has its own executive government, legislative assemblies, and fiscal arrangements. In fact, the two nations are essentially distinct and foreign to each other. They speak different languages, and use not only different weights, measures, and money, but even different thermometers. In contour and climate they also present remarkable diversities, for while more than one-half of Norway has an elevation exceeding 2000 feet, only one-twelfth part of Sweden attains that height above the sea. One-third of Sweden has an elevation of less than 300 feet; and a second third lies between that plane and one of 800 feet. The two countries are divided by a table-topped mountain-chain, called the Kölen, which from Trondhjem northwards forms nearly the whole of the northern part of Norway. Southwards that country expands into a huge lobe of mountainous land, 40 per cent. of the surface of which was calculated by the late Professor Forbes to exceed 3000 feet in height. The chief physical characteristics of Norway are its fjelds, fjords, and forests. The forests clothe the sides of the hills and of the fjords, or firths, if not to their summit, at any rate to the greatest elevation that the climate will permit; and the fjelds are the elevated and generally barren table-lands, which, with isolated higher peaks, form the high ground of the country. Thus the area devoted to agriculture is comparatively small, and very much scattered, consisting generally of the soles of the valleys and the strips of land at the sides of the fjords.

In Sweden, on the other hand, more than one-eighth of the surfaee is occupied by lakes, and almost as large an area is devoted to agriculture. This latter portion is nearly equally divided between natural grass, chiefly in the north, and various other erops; but, as will be seen presently, a very large area of grass is also under rotation. In the north of Sweden most of the surface is occupied by forests or is waste land, and thus the remaining three-fourths of the acreage of the country is accounted for. In those northern regions the cultivated land is also very mueh divided; but in the more southern provinces, such as Scåne, and East and West Gotland, especially around Lake Wettern, there are large cultivated plains with fewer boulders than on the waste lands which abound farther north. Those southern districts offer so fine a field for the employment of steam in the cultivation of the land, that it is most surprising to find the example of Mr. Axel Dickson, of Kyleberg, near Wadstena, who bought one of Howard's sets of roundabout steam-tackle seven years ago, still without a single follower.

Fig. 1.—*Sketch-map of the South of Sweden and part of Norway, showing the greater portion of the Regions reported on.*



Geology.—The geology of Sweden and Norway requires very little description to enable their agriculture to be understood. The solid rocks are mostly granite or gneiss; but other igneous and metamorphic rocks also occur, though they do not constitute large areas; while in the province of Scåne there are small tracts of lands belonging to the Cretaceous and Jurassic formations. Naked rounded hills of inconsiderable elevation but forbidding barrenness bound the sea-coast; and the hollows between them are frequently occupied with swamps and peat-bogs of almost equal poverty. In the cultivated tracts of country, the solid rocks are almost invariably covered by a greater or less thickness of superficial deposits, mostly consisting of glacial clay or marl, generally containing boulders. In some districts these boulders are very numerous and of large size, when, of course, the land cannot be profitably cultivated; in other districts they are relatively smaller and more scattered; and in Scåne, for instance, as already mentioned, they would not generally interfere with the use of the steam-cultivator. Near the east coast, north of Stockholm, as well as at Uddevalla, on the west coast, raised beaches occur in considerable numbers; these, coupled with other evidence, have led geologists to conclude that the northern part of the Scandinavian region is gradually rising above the level of the sea, while it is gradually sinking at the extreme south.

The surface deposits of the cultivated area of Sweden having a tolerably uniform though extraneous origin, the land does not exhibit those extreme diversities of composition to which English farmers are accustomed. Generally, the land is a more or less sandy loam, or a light-coloured clay possessing heavier staple, especially in the central districts, in the neighbourhood of the great lakes, Wenern and Wettern. None of the land that I saw could, however, be compared in stiffness with our heavy clay soils of Liassic, Carboniferous, or London Clay periods; but it may be that the comparative lightness of the land exists more in appearance and mechanical condition than in chemical composition; and there can be no doubt that some of the Swedish clays have a tendency to cake in dry seasons and become sticky after much rain. It is, also, more than possible that long-continued and severe frosts may in Sweden do to the land in winter some portion of the pulverizing that in our moister and milder climate has to be done by the cultivator and the harrow in spring.

Climate.—Most writers of "Travels" in Sweden and Norway have found it necessary to refer to the prevailing belief in England that the climate of those countries is something terrible to contemplate; and so late as 1853, Professor J. D. Forbes wrote as follows:—"The time can hardly be said to be gone by

when an erroneous belief was prevalent as to the utterly inhospitable climate of Norway. Bishop Pontoppidan cites the amusing mistake of our English Bishop Patrick, who describes a Norwegian as imagining a rosebush to be a tree on fire; whereas roses are common flowers in many parts of Norway." Equally mistaken ideas of the agriculture of these regions have therefore naturally been held, and I confess to having been very much startled at seeing tobacco cultivated on an extensive scale so far north as the neighbourhood of Stockholm.

The peculiarities of the climate are long winters, short summers, and long days in the summer season. On the western coast of Norway the climate is relatively mild and damp, owing to the influence of the Gulf Stream; but in Sweden and eastern Norway the climate is dry, and subject to greater extremes of temperature. Again, in the south of Sweden, especially in the province of Scåne, the winters are relatively mild, and there is comparatively little snow; but farther north the winters are more severe and more lasting, and an abundant snow-fall is almost as important to the community as an abundant harvest.* Speaking generally, it may be said that the farther north one travels the shorter is the summer season, the hotter it is while it lasts, and the longer are the summer days. Indeed, to see the "midnight sun" has been the object of many and many a pilgrimage to Hammerfest and Torneå. Thus it happens that in the most northern regions vegetation grows continuously during the short summer season, in consequence of the sun's influence being constantly upon it. The shortness of the summer-night in Scandinavia also tends to render the days hotter than they would otherwise be, as the night is the cooling period; and thus the short interval between seed-time and harvest, which is in some districts as little as six or eight weeks, may be to a great extent explained.† M. Tisserand, in his report on Denmark, has also

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* In the absence of snow the forests could not be worked, for as there are no roads a good fall of snow is necessary to the use of the sledge, the only possible vehicle for the removal of the timber to the beds of the rivers, which, when the frost is gone, float it to the saw-mills and shipping dépôts.

† "In Lapland and the adjoining parts of the most northern provinces of Sweden, the climate is so much against agriculture, that the people are obliged to pile up large quantities of moist wood or brushwood along the north-west side of the small patches of land sown with grain, that in case the wind (in the nights of August) should come from the north-west they may be set on fire to protect the crop from frost, by the smoke diminishing the evaporation from the soil. Another method of protecting the crop from being frozen when in ear, in general use in the northern and middle parts of the country, is for two men to draw a rope across the heads of grain before the sun rises, by which means the drops of dew are shaken off, and the ears become dry before the dew on them is frozen, which takes place (if allowed to remain) just at the time the sun rises."

The above is substantially a quotation from a paper by Mr. Stephens, published in the 'Quarterly Journal of Agriculture' for 1836; but corrected in some details

drawn attention to the influence of light in promoting the growth of crops; and his conclusion is well worth quoting. He observes: "It follows that the progress of vegetation in these high latitudes of the globe bears comparison with that of our regions, in the ratio of an express train to a parliamentary. In the north the stations do not exist, and the progress is quick and uninterrupted."

These conditions will be more completely realised by English farmers if I quote the ordinary dates of a few of the most essential agricultural operations. Throughout Sweden and Norway, where winter-corn can be grown, with the exception of Scåne, rye is sown from the beginning to the middle of August, and wheat from the middle to the end of that month. In Scåne, the superiority of the climate enables these operations to be performed with advantage at least a month later. Leaving that favoured province out of consideration, it is therefore clear that wheat-sowing is an operation that precedes harvesting.

The first out-door work in the spring is generally the sowing of clover and grass-seeds on the autumn-sown wheat or rye. This is often done while the snow is still on the ground, say the beginning of April. As soon in April as the weather will permit, the land is prepared for spring-corn, oats being sown first and barley afterwards. With the exception, again, of Scåne, these operations are usually conducted in May; the oats being occasionally, and in favoured localities, got in by the end of April; but in Scåne spring-corn can always be sown in April, and the May seed-time is devoted to mangolds, turnips, and potatoes.

It is therefore evident that, except in Scåne, the field-work rarely commences before the middle of April, and often not until later. It is interrupted by the exigencies of the hay and corn harvest, the former in July or the beginning of August, and the latter in September; but the whole of the out-door work of the farm must be finished before the end of October or the first week of November. At the outside, therefore, the Swedish and Norwegian farmer has but six working months; and if he is a farmer and nothing more, he has the remaining six months of enforced idleness. But generally he is a forester as well as a farmer, and in winter he utilises in the forest the staff of workmen and horses that would otherwise be eating their heads off on the farm. In fact, but for this combination of foresting and farming, the latter would be a commercial impossibility over the greater portion of the Scandinavian peninsula.

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by Mr. Juhlin Dannfelt, who adds that "the surest remedy against damage by frost is now universally found to be to drain the marshes and low tracts of land as thoroughly as possible, to which important improvement a considerable grant is annually made by the Government."

The following comparative Tables of average temperature and rainfall during the growing season (from May to October inclusive) in the years 1863—1872, in the neighbourhood of Stockholm and at Greenwich respectively, will further elucidate the climate of that part of Sweden during the season of field-work :—

TABLE V.—AVERAGE TEMPERATURE for 10 Years (1863–72) in each of the Months, MAY to OCTOBER, at ENSKEDE, near STOCKHOLM, and at the GREENWICH OBSERVATORY, in degrees Fahr.

	Enskede, near Stockholm.	Greenwich.
May	49°·12	52°·94
June	61·83	58·69
July	68·72	63·09
August	65·55	61·41
September	57·45	57·85
October	45·66	49·68

TABLE VI.—AVERAGE RAINFALL for 10 Years (1863–72) in each of the months, MAY to OCTOBER, at ENSKEDE, near STOCKHOLM, and at the GREENWICH OBSERVATORY, in English Inches, with the Average Number of Days on which Rain fell.

	Enskede, near Stockholm.		Greenwich.	
	Days.	Inches.*	Days.	Inches.
May	7	1·59	10·7	2·13
June	6	2·02	10·	1·93
July	7	2·25	9·4	2·03
August	9	2·56	11·3	2·16
September	9	2·44	11·8	2·47
October	6	2·09	14·6	2·63
	44	12·95	67·8	13·34

As May is the first growing month and October the last over the greater part of Sweden, these Tables contain the elements of a sufficiently precise comparison for agricultural purposes. It will be seen that the average temperature in May is at Stockholm $3\frac{3}{4}$° lower than at Greenwich, where vegetation has already made a considerable growth during the months of March and April. In

* The Swedish inch is 29·69 millim., and the English inch is 25·4 millim., therefore in framing the above Table I have taken the Swedish inch to be one-sixth longer than the English.

June, however, the excess of temperature is 3° in favour of Stockholm, and this advantage is increased to more than $5\frac{1}{2}$° in the month of July. In August the excess is still 4° in favour of Sweden, while in September the average temperatures are about equal at the capitals of both countries. In October the advantage again belongs to England to the amount of 4°, and during the whole of the following months vegetation is at a standstill over the greater part of Sweden, while our climate permits the growth of roots and grass to continue another month, and, in favourable years, almost until Christmas.

The table of rainfall shows that there is a difference of less than half an inch in the total average amount of rain that falls at Stockholm and at Greenwich in the course of the six months; but that at Stockholm this rain is confined to 44 days, or an average of $7\frac{1}{3}$ days per month, while at Greenwich it is spread over nearly 68 days, or $11\frac{1}{3}$ per month, or an excess of 50 per cent. In this respect, also, the English climate favours the growth of both natural and artificial grasses much more than the Scandinavian.

Farm Buildings.

The buildings are nearly always of wood, on stone foundations, and are separated into as many different parts as possible, each house or stall being placed at a convenient distance from the homestead. Thus the barn, stable, cowshed, piggery, dairy, and granary, will be under so many roofs, distinct from each other and from the farmhouse.* Although this arrangement is not conducive to economy of labour or efficiency of supervision, it is obviously necessary in order to reduce to a minimum the possible loss in case of fire. This consideration is by no means fanciful, for several times in the course of my journey I saw traces of the effect of fires on farm-buildings, as well as in towns and villages. Both Sweden and Norway have their Chicago; and it is only necessary to refer to the last occasion, in 1869, when Gefle, in Sweden, was almost totally destroyed, to be impressed with the awful rapidity with which fire extends amongst wooden buildings. Drammen, in Norway, has a similar reputation, and has well earned it in recent years, having been to a great extent burnt down in 1866, and again in 1870. It may, however, be said generally that whatever is lost by the separation of the different buildings is compensated for, as far as possible, by their economical interior arrangements. The cattle are arranged in the cowsheds and feeding byres in one or more double rows

* Here again the province of Scåne presents an exception, the farm-buildings in that district being arranged in a hollow square on the Danish model.

of beasts facing each other, and separated by a walk or tramway, along which the food is brought. The food of the cattle is placed in fixed troughs (*a*, *a*, Figs. 2 and 3) at the sides of this walk, and water is generally given at the regulation time by turning a tap, which causes it to flow into the feeding-troughs; but sometimes the water is given in pails, and in definite quantities to each animal. The straw is generally stored overhead, and is brought into the cowshed by means of trap-doors at convenient places in its ceiling, which forms the floor of the straw-barn. Figs. 2 and 3 illustrate these characteristic features, and also show how, in a well-constructed cow-house, the liquid manure runs into a gutter at the back of the animals, and from it, by means of sinks and underground drains, into a liquid-manure tank outside. The general system is to have all the cattle of every description, no matter how numerous they may be, under one roof; and it often occurred to me, when inspecting a dairy of 150 or 200 milch-cows, to ask what would be done in the event of an outbreak of contagious disease. The answer invariably was that they had had no experience of such diseases amongst their cattle.

The Swedish barn is an institution with which we are not familiar in England; it was originally constructed, in most cases, with a view to its holding and storing the whole of the grain-crops and hay grown on the farm, and to its having, in addition, a sufficient reserve space to admit of the operations of threshing and dressing to be conducted under the same roof. Probably no better evidence of the recent advancement of Swedish agriculture could be given than the inadequate accommodation which the old barns afford for the crops that are now produced. These barns have therefore been supplemented by additional buildings, and in many districts by stacks, the existence of which seemed to me to throw a doubt on the necessity of sinking so much capital in the erection of huge buildings for storing hay and sheaf-corn.

In a country where threshing is the chief occupation of the labourers during a long winter, and where a very large proportion of the produce of the farm is consumed by the live stock and working staff, in consequence of the distance of markets and the necessarily expensive carriage of materials both to and from the farm, a suitable granary is a very important portion of the steading. At the same time, an Englishman can scarcely help questioning the necessity of such large buildings; nor can he help suggesting that the increased use of improved threshing-machines will eventually render them unnecessary, and give the benefit of that better quality which belongs to freshly-threshed grain and straw, whether used on the farm or sent to market.

Figs. 2 and 3.—*Plan and Sections of part of the Cowhouse at Kyleberg, near Wadstena.*

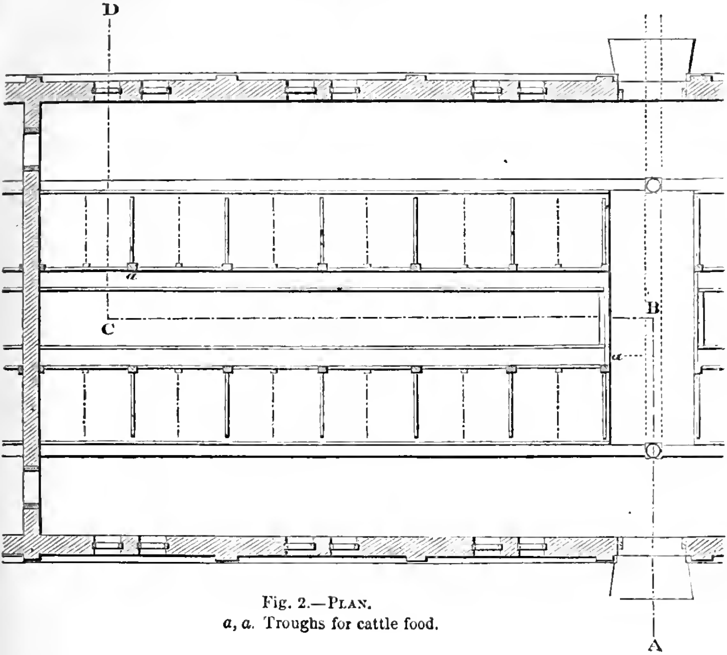


Fig. 2.—PLAN.
a, a. Troughs for cattle food.

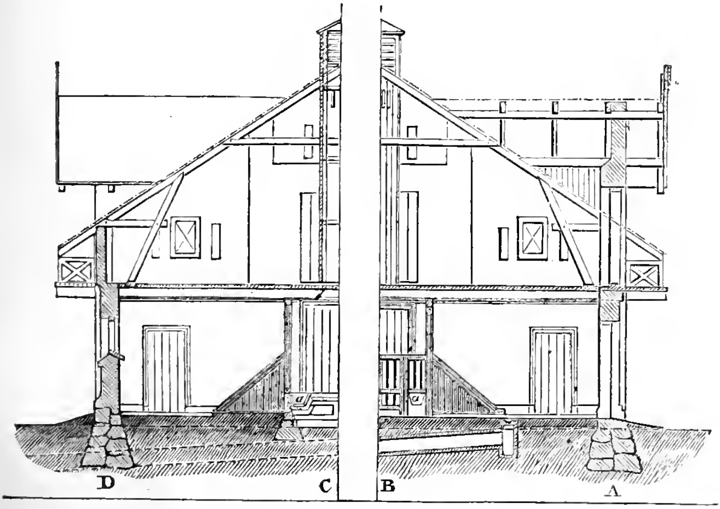


Fig. 3.—Sections parallel to the lines A B and C D.

In materials, the granaries do not differ from the other buildings; they are generally several storeys in height, each flat being well ventilated, not overcrowded, and under constant supervision to wage war against rats and mice, which, on account of the harbour afforded by the wooden buildings, are a great plague to the Scandinavian farmer.

General System of Agriculture.

Sweden and Norway extend through so many degrees of latitude, that the climate must alone cause great diversities in the agricultural practices of the various districts of the kingdom. Yet the general idea is the same, and may be thus briefly sketched:

The system is one of arable-land dairying. The cows are very generally bred by the labourers and smaller farmers, being sold progressively, after they have dropped two or three calves, their places being taken by heifers calving for the first time. The bull-calves are nearly all killed as soon as they are born; and where cattle are bred on larger farms, the cow-calves share the same fate, with the exception of about ten per cent., which are reared in order to take the place, in due time, of old cows that are culled.

In the northern parts of the country the cows are sent during the summer to hill-pastures,* called "Saeter;" the women and children, in the case of small farmers, migrating there to tend the cattle and make the cheese and butter, while the men cultivate the land in the valleys, and join their families on Sunday. In winter, the positions are reversed, for the men work in the forests, and the women live in the valleys, whither they had taken their cattle with them in the month of September.

In the southern provinces there are no such migrations, and the farms are on the average larger, with a comparatively small acreage of permanent grass; but the principal object is still dairying, and it is chiefly carried on by means of grass under rotation. There is, however, a certain amount of land devoted to the growth of "industrial crops," especially tobacco and beetroot, and a fair number of cattle are fed on the refuse of sugar manufactories, breweries, and distilleries, though the dairy cows obtain a large share of these adventitious feeding-stuffs.

With this broad outline in his mind, the reader will be better prepared to understand the more detailed description which follows.

* The smoke arising from damp burning wood is used in the most northern provinces as a protection to the cattle from the gnats or mosquitoes; and the instinct of the animals leads them to place themselves in its midst, for the purpose of getting rid of their tormentors.

Space does not permit me to describe at any length the history of agriculture in Sweden and Norway, so I content myself with the following translation of a brief sketch which refers to Sweden, and which was published in the introduction to the official catalogue of Swedish Exhibits at the Vienna Universal Exhibition. I believe it was drawn up by my good friend Professor Arrhenius. "The oldest system of farming in Sweden is the *burning-system*, in which the forest is cut down and set on fire, the land is enclosed, and sown with rye. This system of corn-growing is now only to be seen at a few localities in Wermland and some other forest districts; but over the rest of the country it has been abandoned. To it succeeded the *hoe-system*, in which the land was worked with a hoe, and the stones were collected into larger or smaller heaps. The land broken up in this manner was sown every year, so long as it would grow corn, and then it was again given over to Nature. The result was the reconversion of the arable land into forest, and in such localities the stone-heaps and remnants of ditches, which are the characteristic signs of this system of agriculture, are everywhere met with.

"In the northern provinces the arable land is, in many places, still cropped on the *one-field system*, that is to say, it is sown annually with summer-corn, potatoes, or flax; and when it will no longer pay to do this, it is allowed to be in grass. By degrees it becomes converted into grass-land, which is then used partly as pasture and partly as meadow. When it has been in grass a number of years, and thereby accumulated a new store of vegetable matter, and restored its fertility, it is again broken up, and for some time used as arable land, when it is once more left to cover itself with herbage.

"This system, the most primitive of all, now occurs only in the most northern regions (Norrland), where, however, as in the remaining part of the country, the farming is now for the most part carried on as a *two-field* or a *three-field* system, and in various localities under differently arranged systems of rotation and of 'twin-culture' (*Koppelwirthschaft* *).

"The *two-field system* † is most general in Uppland, Westmanland, and Södermanland, or in the farmed land surrounding the Mälar Lake. The *three-field system* ‡ occurs mostly in East and West Gotland, in Nerike, on Öland and Gotland, as well as

* This word may be rendered literally "cultivation of enclosed land" as well as "twin" or "double" culture; but the term "twin-culture" best conveys its meaning, which is, that about half the arable land shall be in corn and the rest in artificial grass.

† Corn and fallow alternately. ‡ Winter-corn, spring-corn, and fallow.

in the provinces of Gefleborg, West Norrland, and certain districts of Kopparberg.

"The *four-field system* is more rare, and occurs in Falbygden, and certain other districts of West Gotland and Dalsland, as well as in Småland, Blekinge, and Roslagen, also in the divisions Nedan and Ofvan Siljan, of the province Kopparberg, where also the three-field system is followed.

"The *system of rotations* is general in Scâne, both on the estates of the gentry and on the farms of the peasants. In the remaining southern and middle provinces this system prevails upon nearly all estates and large holdings, and in the last-mentioned part of the country it is adopted by not a few of the smaller proprietors. 'Twin-culture' farms are mostly to be found in Wermland and Dalarne, and also, as is the case with the system of rotations, here and there upon the larger estates, in parts of the country where the reduction in the area of natural meadow and of pasture has rendered necessary the cultivation of artificial grasses.

"Many systems of rotation of crops are to be met with, comprising from 4 to 12 shifts. The oldest 'twin-culture' farms in Dalarne had 10 courses; and now such farms occur in many places worked in from 6 to 16 courses, these last often having a double sowing of clover and grass, one after a manured winter-corn, and another after summer-corn, which had been preceded by a manured and hoed root-crop. The accepted principles of the system of rotations are now recognised in that of twin-cultivation, that corn and fodder-crops shall follow one another, so that straw-crops shall alternate with foliage-crops; and therefore the 'twin-culture' farms are arranged in such a manner that their rotations include several years of clover and grass. The last-mentioned farms are the best adapted to the agricultural circumstances of the country, and permit—in consequence of the grass being left down for several years, as well as the more extended cultivation of root-crops—a profitable rearing (Holländerei) and dairy husbandry, to which general attention is at present devoted to such an extent that a not inconsiderable exportation now takes place, both of butchers animals and dairy products."

The principle of the Swedish rotation of crops is very simple The chief bread-corn used by the people is rye, for althougl bread is also made of wheat, barley, and oats, it has been cal culated that the average consumption per head of the popula tion per annum of the chief vegetable products of the farm is excluding decimals, rye, 5 bushels; wheat, 3 pecks; barley 3 bushels; oats, $1\frac{4}{5}$ bushel; peas, $1\frac{2}{5}$ bushel; and potatoes, 7 bushels.

To grow rye in so northern a climate as that of Sweden, it should be sown in the beginning or middle of August; and as it does not succeed unless the land has been allowed to get stale before seed-time, the preparation of the seed-bed should be completed by the middle to the end of July. Thus, as a rule, no crop is taken in the year in which the rye is sown. Commencing, therefore, with a bare fallow, which is always dunged, and sometimes receives a small dressing of superphosphate as well, the second year will see the harvesting of rye or wheat, on which clover and Timothy-grass had been sown in the early spring. The land remains in grass for two or three years or more, and is then cropped with oats for another two or three years in succession, unless the second white crop is barley in the place of oats.

This is the prevailing rotation, especially with the smaller farmers, and in the more remote districts, where rye would be dear to purchase on account of the expense of transit; but a few of the more calculating farmers in other districts have come to the conclusion that a crop which practically monopolises the land for two years must cost a great deal of money by the time it is placed in the granary. Therefore they have sown a portion of their fallow-course with roots, and taken barley instead of winter-corn the second year. Some farmers take a root-course after the ley-oats, and then a crop of oats or barley before the bare fallow, while others, again, have long rotations, including several years of grass, or intercalations of green crop every second or third year. The following are examples:—

Mr. Ivar Kylberg, Grästorp, on Lake Wenern.

1. Fallow (chiefly sown with a green crop).
2. Rye or Wheat.
3. }
4. } Grass.
5. }
6. Oats or Barley.
7. Green Crop.
8. Wheat.
9. Oats or Barley.
10. Turnips.
11. Rye or Wheat.
12. Oats or Barley.

Mr. Steinbeck, Gudhem, near Falköping.

1. Bare Fallow.
2. Rye or Wheat.
3. Barley.
4. Green Crop.
5. Turnips with Dung.
6. Barley with Clover, &c.
7. Grass, cut.
8. Do. do.
9. Do. do. (limed).
10. Do. do.
11. Do. fed.
12. Do. do.
13. Do. do.
14. Barley.
15. Oats.

Mr. Fogelmark, Wall, near Gefle.

1. Bare Fallow or Turnips.
2. Rye (after bare Fallow), or Barley (after Turnips).
3. Grass, cut.
4. Do. do.
5. Do. do. dunged.
6. Do. do. } aftermath
7. Do. do. } grazed.
8. Oats.
9. Oats.

Other variations of the national system of rotations will be mentioned in the sequel, but the preceding illustrate some points of interest. Mr. Kylberg's farm is near the southernmost shore of Lake Wenern, and his object is to have one-fourth of his land in artificial grass, one-fourth in winter-corn, a third fourth

in summer-corn, and the remainder in green-crop, which is either turnips, tares and oats, buckwheat, &c., cut green for the cattle and horses. Mr. Steinbeck's farm is farther north, and consists of much stronger land; his rotation is a good illustration of the system of keeping such land in grass for seven or eight years, and also of a by no means uncommon plan of taking turnips after a previous green-crop, generally consisting of tares and oats cut green. This rotation may be conveniently contrasted with the short course adopted by Captain von Braun, at Rydaholm, near Wara, also on strong land in the same district; viz. (1) fallow, mostly bare; (2) wheat or rye; (3) and (4) grass; (5) oats. This shift has the disadvantage of keeping nearly one-fifth of the farm unproductive every year; but Captain von Braun thinks that he is repaid by his large crops of corn, which he puts at 4½ quarters of wheat and 9 quarters of oats per English acre. The third rotation given above is taken from a farm much farther north—in fact, many miles north of Stockholm. It also illustrates in every essential particular the characteristic rotation in Norway, as well as the following improvements upon the ordinary shifts: the growth of turnips on half the fallow-course, which generally necessitates the growth of barley instead of rye on that half the next year; the grass being manured the third year; and only two crops of oats taken in succession, instead of the three or four that are customary in Norway and the north of Sweden.

The following rotation, pursued by Mr. Hay, of Jonköping, the Managing Director of the celebrated match-factory, on a small farm in the neighbourhood of that town, illustrates in its latter stages a somewhat exhaustive style of farming, which could only be followed successfully by the aid of a liberal expenditure on artificial manures, and the high feeding of a numerous head of stock. The rotation is, (1) tares; (2) wheat; (3), (4), (5), and (6), grass; (7) wheat; (8), (9), (10), wheat, barley, or oats, according to the condition of the land. It should be noted that Mr. Hay has been in the habit of applying his farmyard-manure to the fallow-crop, about 150 lbs. of superphosphate per acre to each corn-crop, and poudrette, purchased from the factory people, to his grass-land. He also has good strong land, and a climate which permits wheat to be sown as late as the beginning of September.

The following Table, showing the acreage in Sweden under each kind of crop, under bare fallow, and grass under rotation, for the years 1867 to 1872, indicates a very remarkable uniformity of farm-practice under the system of cropping which I have termed the "national rotation:"—

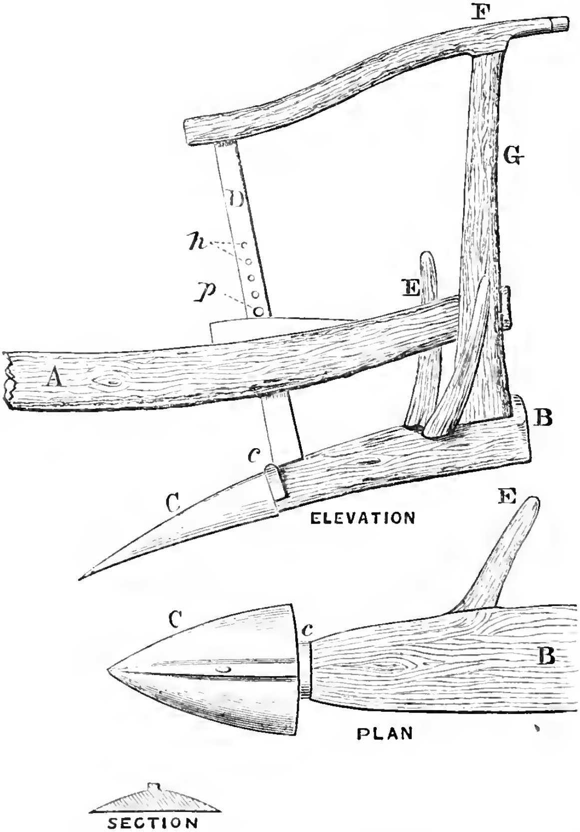
Table VII.—Showing the Acreage in Sweden under each kind of Crop, Bare-fallow, Grass, Forests, &c.

Year.	Winter Corn.	Spring Seed.		Potatoes.	Other Root-crops.	Fibre-crops.	Grass and other Fodder-crops for		Other Crops.	Bare Fallow.	Total Arable and other Cultivated Land.	Natural Pasture.	Forests.
		Corn.	Pulse.				Pasture.	Harvesting.					
	Swedish Tunnland of 1¼th Acre per Tunnland.												
1872	827,487	1,742,802	110,217	292,198	23,335	32,869	275,507	1,180,570	6,561	794,969	5,261,800	4,004,151	35,271,400
1871	819,732	1,703,824	109,416	290,084	23,311	33,268	272,420	1,141,754	7,393	787,911	5,192,488	4,023,382	35,322,495
1870	808,069	1,691,018	109,940	287,074	23,055	33,514	275,497	1,115,378	8,021	783,261	5,160,854	4,023,193	35,244,414
1869	793,351	1,660,082	110,707	277,699	18,954	33,500	269,059	1,101,583	9,972	779,558	5,058,744	4,002,149	35,429,373
1868	753,947	1,555,321	106,064	259,768	17.060	30,007	258,877	1,080,742	9,578	750,786	4,937,294	3,943,686	
1867	745,570	1,542,948	108,091	252,056	15,143	31,162	250,444	1,050,896	9,385	745,199	4,919,884	3,923,820	
Average in Tunnland . . .	791,359	1,649,332	109,072	276,480	20,148	32,386	266,967	1,111,820	8,485	773,614	5,089,010	3,986,730	
Average in Imperial acres .	949,630	1,979,198	130,886	331,776	24,177	38,863	320,360	1,334,184	10,182	928,337	6,208,592	4,863,810	

Cultivation of the Land.

Fallow.—The bare fallow is generally prepared by ploughing the oat-stubble 6 or 7 inches, before the season is too far advanced in the autumn. Early in the spring, that is to say, in the month of May, it is harrowed, and then either ploughed again or worked with a native kind of scuffler called an ård, illustrated in Fig. 4. The farmyard manure is always applied to

Fig. 4.—*Sketch of the Ård, Årdret, or Order.*

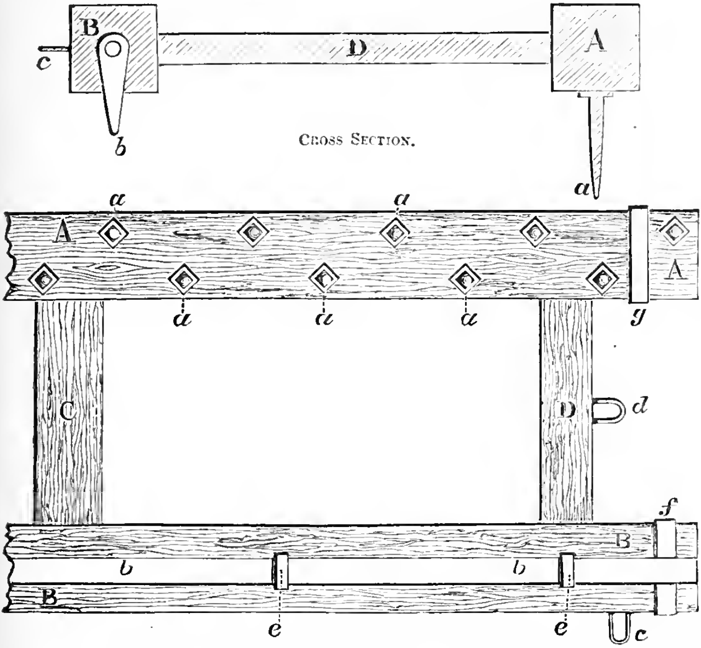


A. Beam.
B. Sole.
C. Iron share.
D. Iron vertical shaft to regulate depth of work by the holes *r* and the pin *p*.
E E. Digging-breasts.
F. Handle.
G. Hinder vertical shaft, supporting the handle.
c Iron collar.

this shift, either wholly or partially, and is got on the land about the end of June or beginning of July. It is turned under

by means of the plough or the årđ, and the land is afterwards harrowed, and allowed to settle, so as to be fit for rye-sowing by the beginning or middle of August, or for wheat-sowing about a fortnight later. Just before sowing, the land is finally worked with a heavy harrow, or a native quadrangular implement, called a "sladd," a sketch of which is given in Fig. 5.

Fig. 5.—*The Sladd.*



Plan of one-half the length of the implement, showing the side that may be used as a harrow and scraper, the other side being plain, and used as a roller or clod-crusher when weighted.

A. B. Longitudinal beams.
C. D. Transverse beams.
a. a. Harrow teeth (iron).
b. b. Iron scraper.
c. d. Iron staple for the attachment of the horses or bullocks.
e. e. Iron clamps.
f. g. Iron collars.

This and the årđ are wooden implements; but iron ploughs of native manufacture and good quality, though perhaps wanting in finish, may be purchased in Sweden at very low prices. Some farmers, like Mr. Insulander, of Claestorp, whose bare fallow follows turnips or vetches, manage to cart a portion of the manure on to the land, and to plough it in, during the brief autumn.

I have stated that a portion of this course is sometimes sown with tares, to be cut green in July, and followed by rye or wheat; or with turnips followed by barley. In either case the seed is got in as early as the season will permit. Mr. Hay

grows tares on the whole of his fallow-course on strong land, and sows wheat early in September; but he was long looked upon as a madman by the neighbouring peasant-farmers. The official returns for Sweden well illustrate the national practice; and they show that, taking the average of the years 1867-72 inclusive, 949,630 acres were annually planted with winter-corn, while 928,337 acres were in bare fallow.

Rye or Wheat.—Rye-sowing commences about the beginning of August in the central districts, and wheat-sowing follows immediately afterwards. In the more southern regions, especially in Scåne, rye is not sown until about the middle of September, and wheat is put in as late as the first week in October. Amongst the best farmers the quantity sown is about two bushels per acre; but 14 to 15 pecks is not uncommon on peasant farms. According to the Swedish returns the quantity of seed used for winter corn varies from ·59 of a tunna per tunnland (9 pecks per acre) in Jemtland (a high northern district), to as much as a tunna (15 pecks per acre) in Elfsborg län. In Malmöhus län (the most southern province) the average quantity given in the official statistics is ·79 tunna per tunnland, or 12 pecks per acre.

The seed is generally sown broadcast on the bare fallow, which has been manured and prepared as already described. If tares or other green crops have been grown on the fallow, it is usual to apply to the land a dressing of 150 lbs. of superphosphate per acre when preparing the seed-bed for winter-corn. These practices, however, are found very rarely except on large estates farmed by the owners, and on the farms held in connection with the agricultural schools and colleges. On farms of that stamp the winter-corn would also be drilled. Wheat is not unfrequently harrowed in the spring, but rye is not touched.

Harvesting is generally got through during August or the early part of September, and most commonly with little or no extraneous help. The Swedish official returns give the average crop of winter-corn for the last eight years at about 19 bushels per acre; but I met very few people who would own to less than twice that quantity. No doubt the very best farmers, having good land, their own property, may reckon upon getting from 30 to 35 bushels or more per acre in fair years; but I was frequently told of such harvests where the stubble did not bear out the assertion.

Grass.—The seeds are sown on the young wheat or rye in April, frequently, and preferably, in some parts of Sweden, while the snow is still on the land. Some idea of the mixtures used may be gained by the following examples. (1) On a central farm near Sköfde, between the Lakes Wenern and Wettern,

14 lbs. Timothy grass, 7 lbs. red clover, $2\frac{1}{2}$ lbs. white clover, and 7 lbs. alsike, per imperial acre; (2) on a much more northern farm, near Gefle, the quantities were, 18 lbs. Timothy, 9 lbs. alsike, 4 lbs. red clover, and 2 to $2\frac{1}{2}$ lbs. white clover, per imperial acre; and (3) on a farm near the south-eastern shore of Lake Wettern, 13 lbs. Timothy grass, 10 lbs. red clover, 7 lbs. alsike, and 4 lbs. trefoil, per imperial acre.

The grass remains, as we have seen, from two or three to as many as six or seven years. In the shorter rotations it is usually cut once in the first year or two, and either partially or entirely fed the third. In the case of longer rotations it is cut three or four years, being dressed with lime or compost the second or third year, and cut the last three years. Some farmers, however, prefer to alternate the mowing and feeding; while others, again, never feed anything but the aftermath. As a rule the red clover disappears, more or less, after the first year, and then the value of the Timothy grass is felt.

The spring climate of a large portion of the south of Sweden renders the growth of good grass a very difficult achievement. The comparatively warm days of that season are succeeded by very frosty nights, and this alternation of nocturnal frosts and diurnal thaws not only destroys the roots of the grasses, but also honeycombs the land in a very remarkable manner. I was told that north of the Götha Canal, where the advent of spring is later but more pronounced, there is not the same difficulty; and it is quite within our own experience that grass and wheat both suffer severely from repeated and violent fluctuations of the weather, in the form of alternations of wet and dry periods, or of frosts and thaws. The shortness of the summer season must also, as already suggested, reduce the average of the crop of grass.

The quantity of land in Sweden sown with grass and fodder crops in rotation is 1,654,544 acres, of which only 320,360 acres are returned as pasture, and the remainder are mown.

Oats.—The grass is generally ploughed in the autumn about six inches deep, after having been limed, by the best farmers, if the land is strong; it is then left until the end of April or beginning of May, when it is harrowed, and sown with about 4 to $4\frac{1}{2}$ bushels of oats per imperial acre. The seed is harrowed in, and nothing further is done until harvest-time, which generally falls about the end of August to the middle of September, according to the season and district. When oats follow a previous corn-crop the method pursued is the same, except that the best farmers apply from 150 lbs. to 2 cwt. of superphosphate or Mejillones guano per imperial acre. Good crops are stated to be from 36 to 48 bushels per imperial acre.

Barley.—This crop succeeds either oats or turnips in the greater portion of Sweden and Norway; but in some favoured districts it is taken after sugar-beet. Barley-sowing follows the oat seed-time; and the land is prepared very much as that for oats after a previous corn-crop. Many good farmers, however, who take barley between two crops of oats, give a dressing of farmyard-manure to their barley-land. In that case the manure is carted on to the land early in spring, to the amount of 10 to 15 tons per imperial acre, and is either ploughed or harrowed in according to the strength of the land. The barley is sown generally about the beginning to the middle of May, except in Scåne, where it is got in by the middle of April. Four bushels of seed per acre, generally of the six-row variety, is not an unusual quantity; and the average quantity of seed used for all kinds of spring-corn in the years 1865–72 inclusive, according to the official returns, is no less than 4½ bushels per imperial acre. The crop varies very much according to circumstances, being largest after sugar-beet; for a very good farmer it may be put down at 36 to 40 bushels per acre, but rising to as much as 50 under very favourable circumstances. The official average crop of spring-corn for the whole kingdom of Sweden in the years 1865–72 inclusive, is 23·8 bushels per imperial acre; and the extent of land sown is, on the average of the six years ending with 1872, as much as 1,979,198 acres.

When barley is taken after turnips or beetroot the land requires no preparation in the autumn, and in the spring it is merely harrowed or "sladded," sown, and the seed harrowed in. The assertion that the crop after beetroot is so superior to that after any other crop may be accepted as the truth without much question, on account of the comparatively heavy manuring, and the careful cultivation which the land receives in preparation for that crop, as well as the careful cleaning during its growth. Drilling spring-corn is not generally liked in Sweden. The time of spring-sowing is also a matter on which differences of opinion prevail, and my notes contain records of practice varying from the middle of April in Scåne, to as late as the beginning of June on Mr. Swartz's farm not far from Wadstena. When I saw this farm in the middle of September, the late-sown six-row barley was still green, but giving the promise of a very heavy return if it could be safely housed; and I have every reason to believe that the exceptionally dry autumn which prevailed in Sweden this year brought this risky speculation to a successful issue. It seemed more hazardous than its avowed object—the reduction of annual weeds—would warrant.

Turnips.—A root-course is comparatively rare in the rotations pursued on Swedish and Norwegian farms, although a certain

breadth of potatoes for home use is generally grown. Turnips are sometimes taken after oats instead of barley, on either the whole or a part of the course, and in other cases on part of the fallow course, which is then followed by barley instead of rye. The stubble is ploughed in the autumn as for bare fallow, and harrowed in the spring; or if the ploughing cannot be done in the short autumn it must be a first consideration in the spring. About the middle of May the land is grubbed to the depth of 10 inches, harrowed, if possible, and set out in ridges from 24 to 28 inches wide, with the double-mouldboard plough. Farmyard manure is laid in the drills to the amount of 15 tons per acre, and 1 to 2 cwt. of superphosphate added. The ridges are split, and about 4 lbs. per acre of turnips sown. This is an advanced system of turnip-cultivation, and is rarely to be seen. More frequently no farmyard-manure is applied, and the superphosphate is sown broadcast directly after the spring harrowing. The land is ridged, and 7 or 8 lbs. of turnip-seed drilled per imperial acre.

The cleaning of the land is mostly performed by means of a bow-scraper which works in the furrows, and the plants are thinned and singled by children to about 10 inches apart. In October the roots are lifted, topped and tailed, and stored in long pits or pies, or in houses, for use as required during the winter. The total extent of land under all kinds of root-crops, in Sweden, has averaged only 24,177 acres for the years 1867–72 inclusive. It will be seen in the sequel that the reason why turnips are not more extensively grown is that on most of the farms in the Scandinavian Peninsula the principal object is dairying. It is not that the climate prevents their cultivation or renders it difficult, for throughout the country, from Malmö in the south to Gefle in the north, I occasionally saw exceedingly good crops of swedes and of white and yellow turnips.

Sugar-beet.—This root is grown on a fair number of farms in the south and centre of Sweden, in localities near certain towns, such as Landskrona and Wadstena, where sugar-factories exist. The crop is generally sold to the sugar-makers at a price equal to rather more than 21*s.* per ton, which may be increased to nearly 24*s.* in the winter-season in some districts. From one-fifth to one-sixth of the weight of the roots may be bought back as pulp, at prices varying from 13*s.* 4*d.* per ton, in the case of the larger percentage, to 16*s.*, or even 18*s.* 6*d.*, in the case of the smaller. It is of course obvious that the quality of the pulp is better in the latter case, as the difference between the larger and smaller percentage of weight returned as pulp consists almost entirely of water.

The following method of cultivation is pursued by Mr. Swartz, of Hofgården, near Wadstena, who grows annually 100 acres of sugar-beet after barley. The stubble is ploughed in the autumn as soon as possible, and if the weather permits, the land is gone over afterwards with theård. The dung is carted out and spread during the winter to the amount of 10 or 11 tons per imperial acre. In the spring the land is cultivated, or rather, deeply harrowed, twice or thrice in cross directions; the depth reached being about 7 inches. After this, about 2 cwt. of superphosphate (containing 15 per cent. of soluble phosphate guaranteed) is sown per acre, and harrowed in. About 28 lbs. of seed per acre is then drilled in rows about 18 inches apart. This operation is performed between April 28th and May 10th as a general rule, and is always the earliest spring-sowing on Hofgården. Rolling is a favourite practice with sugar-beet growers, but Mr. Swartz never practises it. The argument is that it hastens vegetation, but Mr. Swartz prefers to get in his seed as early as possible on well-prepared land, and in view of the trying and uncertain spring climate in his locality, to carefully avoid any mode of procedure that would unduly hasten its germination.

When the plants are sufficiently grown to enable the rows to be seen, the land is horse-hoed between them, and the plants are weeded. The horse-hoe is used a second time, and the plants are then singled to about 9 or 10 inches apart. The next operation is performed with a "beet-lifter," but with the shares arranged, at this stage of the cultivation of the crop, to act as a grubber between the rows, working as deeply as can be done by a pair of horses, generally about 7 inches. This same implement is employed as a "lifter" when the crop is ready, the shares being turned to work beneath the roots. The cultivation of Mr. Swartz's 100 acres of sugar-beet necessitates the employment of 40 boys, girls, and women, during the season, at an average wage of 8*d.* per diem.

Harvesting is done by boys and women at from 15*s.* to 18*s.* per acre, including the collection of the roots and the leaves, each into a separate heap for every half-acre cultivated. The leaves are not regularly heaped, but are collected together, and taken off as required for the cows, each of which gets about 3 imperial stone per day, the average produce of an imperial acre being something under 3 tons of leaves. Mr. Swartz assured me that the leaves of the sugar-beet would stand an immense amount of severe frost without injury. The roots are made into long heaps on each half-acre (Swedish), covered with earth, and sent to the sugar-factory at Wadstena as desired. The crop varies from 12 to 18 tons per imperial acre.

The following details in the method of cultivation pursued by

Mr. Tranchell, a sugar-manufacturer, on his farm of Säbyholm, near Landskrona, in the south of Sweden, exhibits some important divergences of practice. The stubble is ploughed in the autumn to the depth of about 10 inches, either by horses or oxen. In spring, a good tilth is obtained by harrowing, and the land is then sown with about 150 lbs. per acre of bone-dust, a similar quantity of guano, and 75 lbs. of potash-salts. These manures having been harrowed in, the land is rolled, and then drilled with from 20 to 25 lbs. of seed per acre, in rows 18 inches apart, the plants being eventually set out to 10 inches apart. After drilling, the land is rolled again, and if necessary, in consequence of becoming baked, it is harrowed about eight days afterwards. When the plants are about an inch high, the horse-hoe is passed between the rows; and this operation is repeated five or six times during the summer. When the plants have three or four leaves, they are thinned out and singled by hand. Early in the summer they are cleaned, and the earth raked away from the roots, by women at about 10*d.* per day, each imperial acre occupying one woman from seven to ten days. About the end of June, or beginning of July, the roots are again covered with earth, by means of a horse-hoe, after which they require no farther attention until harvest-time.

The beetroot harvest in this district generally falls about the beginning of October, and is done at from 18*s.* 6*d.* to 22*s.* per acre, including pitting and covering with 12 inches of earth. Mr. Tranchell finds that the roots contain an average of 12 per cent. of sugar; and he also informed me that most of the farmers from whom he purchases roots do not claim their privilege of buying back the pulp, an abstention that doubtless pays him very well indeed. The cost of manual labour in the cultivation of sugar-beet amounts to 3*l.* per acre, on an average of 300 imperial acres of this crop grown annually by Mr. Tranchell.

Without going into fiscal matters, it may be worthy of mention that Mr. Tranchell's factory at Landskrona commenced work in 1850, but that it remained the only one in Sweden until 1869, although many experiments were made in the interval in most of the southern and central provinces of the kingdom. In 1869, however, another factory was built near Stockholm, and was followed, in 1870, by one near Malmö, at Arlöf; and in 1871, by the one referred to near Wadstena, as well as by others near Halmstad and on the Ljung estate. In addition to these factories, and as accessories to them, it has been attempted to carry out the process of manufacture in its earlier stages upon large farms, and to forward the crude product (*Kalkzucker*) to the factories for the completion of the manufacturing and refining processes.

Potatoes.—Throughout Sweden and Norway potatoes are generally grown; but it is chiefly in Hedemarken, in the latter country, and in the southern provinces of the former, that they are cultivated on an extensive scale for the manufacture of spirit. In round numbers, 350,000 acres were planted in Sweden in the year 1872, and the crop amounted to 45,000,000 bushels, or 130 bushels per acre. Taking the bushel to weigh about half a hundredweight, this would give an average production of 3 tons 5 cwt. per imperial acre. By Table VII., p. 183, it may be seen that the average quantity of land under potatoes during the six years included in it was 331,776 acres, and that the cultivation of the tuber has during that period been progressively extending. According to the official returns, the average crop for the eight years ending with 1872, was 116·9 bushels per imperial acre. The cultivation of the land is the same as for roots, and the potatoes are planted from the end of April until the third week in May. The crop is chiefly harvested by women, who work in gangs, numbering in some cases twenty or thirty people. The women receive 7½*d.* to 8*d.* per day, and as many potatoes as they can eat, and the overseer about 1*s.* 8*d.* per day. These long rows of women, on their knees, getting the potato-harvest with their fingers as much as with their hoes, and superintended by a man, who walks to and fro keeping them at it, seemed to me the most disagreeable examples of agricultural labour to be found in Sweden, and especially in the province of Scåne.

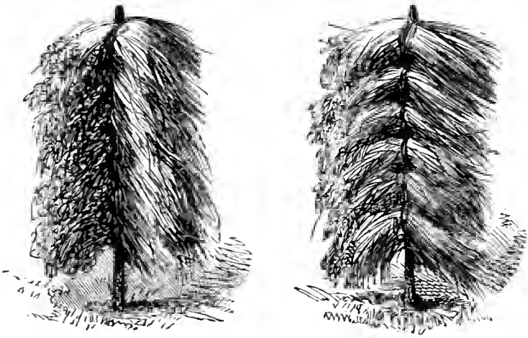
Pulse.—On an average, according to the official returns, about 130,000 acres of pulse-crops are grown in Sweden every year. A proportion of this area doubtless consists of tares grown on the fallow-course preceding winter-corn; and the greater portion of the remainder is taken after ley-oats on a part of the course, in place either of barley or a second crop of oats. The cultivation of the land in the first instance has been already described under the head of bare fallow; and in the second case it would be the same as for barley. The official returns for Sweden further give the average amount of seed used as 3½ bushels per acre, and the average crop as 16·3 bushels.

Tobacco.—This crop is cultivated in the neighbourhood of Stockholm and other large towns, from which plenty of manure and occasional labour can be obtained. The total amount of the crop throughout the kingdom has not been published, but I have seen as much as 10 acres of tobacco on one farm in the south, and the quantity grown near Stockholm alone has been stated at more than 200 tons per annum. As a rule it is grown year after year on the same land, which is very heavily dressed with town-manure and guano.

Harvesting.

The climate of Norway and the North of Sweden renders the harvesting of the crops in good condition somewhat difficult. I was therefore curious to learn what expedients, if any, were resorted to in the case of wet or frosty weather; for even "snow in harvest" would not be looked upon as a miracle in some of these northern regions. The most common plan is to spit the sheaves on poles, which are planted in the field for the purpose, in long rows, at equal distances from pole to pole, and from row to row. Either the poles are stuck through the sheaves, or the sheaves are bound to the poles in couples, one on each side, as in Fig. 6. The number of sheaves piled one above the other varies according to circumstances, but generally an interval is left between the lowest sheaf and the ground, unless it is occupied by an upright sheaf forming a support for the horizontal ones above. Peas, tares, &c., and frequently even clover and grass, are dried by being hung across rails, or a kind of hurdle or fence, on the plan of a common clothes-horse.

Fig. 6.—*Sheaves bound to Poles to hasten their drying, as practised in Sweden and Norway.*



Reaping-machines are slowly making their way (the American "Buck-Eye" is most often seen); but their more general adoption is retarded by the existence of so many open parallel drains—which are rendered necessary by the sudden thawing of the snow in the spring—as well as by the fact that the regular staff of servants engaged by the year to work on the farm in summer and in the forest in winter is so large as to render the Scandinavian farmer comparatively independent of mechanical aids in the operations of reaping and mowing.

Live Stock.

The annexed Table (VIII.) gives the number of head of farm stock in Sweden in each of the years 1865 to 1872 inclusive, and the number in Norway in 1865. Comparing the Swedish figures for 1872 with those already given (Table VII.), of the quantity of land under cultivation and in natural grass (exclusive of forest and mountain-pasture) in that country in the same year, the number of horses, cattle, sheep, and pigs, per 100 acres in Sweden, and those in Great Britain, according to our own Agricultural Returns (also exclusive of mountain pasture), are as follows:—

	Horses.	Cattle.	Sheep.	Pigs.
Sweden	4·0	18·9	14·9	3·6
Great Britain	6·8	18·1	90·0	8·9

A reliable comparison with Norway cannot be given; but if we assume the acreage of land under cultivation in Norway in 1865, given in the Agricultural Statistics of Great Britain for 1873, to be approximately correct, then the number of live stock per 100 acres was as follows:—Horses, 5·1; cattle, 33·3; sheep, 60; and pigs, 3·2. It is tolerably clear, however, that the 2,840,500 acres of land stated in our own Statistics to include all kinds of crops, bare-fallow, and grass, cannot include the natural grass of the Saeter, which, throughout Norway, almost entirely supports the stock of cattle and sheep during the summer months, and also, to a certain extent, furnishes the hay for their winter keep.*

It should also be mentioned that, in addition to the stock included in Table VIII., Sweden possessed 118,438 goats in 1872, and Norway 290,650 in 1865, as well as 101,750 reindeer.

Horses.

The average number of horses per 100 acres of land, exclusive of the forest and mountain pasture, is, both in Sweden and Norway, much less than in England, although the short season for farm-work, the demand for horse-labour in the forests, and the comparatively small mileage of railways, are conditions that all point to an opposite result. It must, however, be remembered that, on the one hand, the Norwegian and Swedish cattle include a large number of draught-oxen, amounting in Sweden to probably at least 2 per 100 acres, as the total number of oxen is equal to

* I regret that I have been unable to make use of the official statistics relating to the cultivation of the land in Norway, as my calculations of the quantities into English weights and measures gave results that were evidently erroneous, when compared with similar calculations relating to Sweden and Denmark.

TABLE VIII.—Showing the NUMBER of ANIMALS of the FARM in SWEDEN in the YEARS 1865–72, and in NORWAY in the YEAR 1865.

		Horses.	Cows.	Oxen.	Bulls.	Young Cattle under 2 Years.	Sheep.	Goats.	Swine.
SWEDEN	1872	446,309	1,297,950	280,589	44,487	480,293	1,659,644	118,438	401,202
	1871	438,090	1,265,387	271,381	41,758	447,804	1,636,201	124,673	382,811
	1870	428,446	1,231,477	269,762	38,647	426,014	1,595,009	124,326	354,303
	1869	420,859	1,186,909	264,474	37,059	385,927	1,539,079	121,911	339,248
	1868	401,019	1,119,946	251,635	34,533	335,878	1,409,195	122,423	300,021
	1867	433,959	1,242,468	284,573	39,094	411,002	1,621,981	125,884	362,371
	1866	437,159	1,234,935	284,554	39,320	424,303	1,644,781	131,711	386,606
	1865	428,169	1,185,556	282,844	38,791	417,163	1,589,875	133,132	380,165
NORWAY	1865	144,940	680,825		264,765		1,701,710	290,650	91,940

2·5 per 100 acres of agricultural land. Then, on the other hand, it must equally be borne in mind that only about three-sevenths of our English horses are used in agriculture (one-seventh are brood-mares and young animals, and the remaining three-sevenths are used for non-agricultural purposes), though what is the proportion used in the cultivation of the land in Sweden and Norway the published statistics do not enable me to ascertain.

In Norway there are two distinct breeds of horses, namely, the larger, or Gudbrandsdal breed, and the smaller, or Nordfjord breed. The latter is well known as the compact and hardy dun-coloured Norwegian pony, from 13 to 14 hands high, with dark legs, mane, and tail, and a dark stripe along the back. The Gudbrandsdal horse is somewhat larger, without any speciality of colour, and has its home, as its name implies, in the district of Gudbrandsdal, in Hedemarken. Pure specimens of the latter breed are now rarely seen, as it has been very much crossed with Danish blood. Some hundreds of horses are annually exported from Norway, chiefly to Sweden.

The following descriptions of these breeds, translated from Mr. Smitt's 'History of Norwegian Agriculture,'* will further elucidate this subject:—

"The horse of the Fjord districts is distinguished by a very compact and powerful build in proportion to its size. The head is sometimes a little rough, but most often well-formed; the forehead is broad, and smoothly united with the straight nose; the ears are small, on the inside thickly covered, or filled, as it were, with rather long hairs; the eyes are lively, and have a gentle expression; and the disposition of the animal is generally friendly and docile. The head is rather stiffly connected with the neck, which is short, thick, and strong, with a short stiff nape and a strong mane. The back is most often straight; the loin short and broad; the buttocks bread and strong, sometimes straight, but more often somewhat slanting; the chest is broad; the legs small, but strong and well placed; the hoofs small, commonly black; the hams often somewhat crooked, but strong, with little disposition to spavin. The chest is vaulted and deep, the shoulder sometimes a little oblique, the flanks short. Taken as a whole, this horse may be said to be rather short than long in the body.

"The colour is most usually yellow—dun-coloured yellow—white, or mouse-grey, with a mixture of black in the tuft of hair on the top of the head and the tail, black along the middle of the mane, a black stripe along the back and black, black-grey, or brownish feet from the fore-knee and the ham to the hoof, with black cross-stripes on the back of the fore-knee, and black hoofs. In general it may also be observed that the outer streak and the points of the ears are black. A brown colour, with black tuft of hair, black mane, tail, and stripe along the back, black feet and ear-points, is very frequent. How far this colour originally belongs to this race, or has been introduced through crossing with foreign breeds, would perhaps be difficult to decide with any certainty, but that it is due to crossing may perhaps be considered as the most probable. The size is usually about 13 to 14 hands, reckoned from the mane to the uppermost streak of the outer side of the hoof.

* 'Det norske Landbrugs Historie i Tidsrummet 1815-1870.' Af J. Smitt. Christiania, 1874.

"The Gudbrandsdal horse has, in all probability, partly obtained its present characteristics through crossing with Danish breeds. It is known that about the middle of the last century, and the period immediately succeeding, Danish stallions were introduced into Gudbrandsdal for stud purposes.

"The Gudbrandsdal breed is larger than the Fjord horse, about 14 to 15 hands, sometimes rather bigger, and shows evidence of something having been done for its improvement, through a more careful selection of sires, as well as through better treatment in rearing.

"The head, as a rule, is more delicate, the ears larger, with more lively motion. The judges of horses in the Gudbrandsdal district are particular about the horse having the right sort of ears. The eyes are large; the neck not exactly long, yet longer and not so stiff as in the Fjord horse; the nape and the connection between the neck and the head is better in the Gudbrandsdal horse, and it frequently has a very fine bearing. The back is rather straight; the buttocks sometimes straight, but often somewhat slanting; the chest is deep, and the ribs vaulted. The whole frame is proportionately somewhat longer than that of the Fjord horse. The legs are strong and well placed. Altogether this breed is strongly built.

"The colour is more often brown, with black tuft of hair on the head, black mane and tail, and sometimes black feet. Chestnut, grey, and black horses of this breed are also frequently to be met with."

In Norway, Government stallions, for the use of the farmers of the several districts, are placed on conveniently situated farms. I visited such a farm, between Christiania and Drammen, which was 500 feet above the sea-level. The stallion was of the Gudbrandsdal breed, and the covering fee was 13*s.* 6*d.* per mare, if they went to him, but if the horse went into the hills the fee was 1*l.* 2*s.* 6*d.* per mare. This stallion had covered 56 mares last season. The fees went to the Government, and the farmer was allowed 1*s.* 1½*d.* per day for the horse's keep.

In Sweden there are three State establishments, similar to the French *Haras*, on a tolerably large scale. They are all under the supervision and control of the manager of the chief establishment at Strömsholm, in Westmanlands län, where 75 stallions, 71 mares and fillies, and 2 geldings were kept at the time of the latest returns. At Flyinge, in Malmöhus län (Southern Sweden), there were 34 stallions, 23 brood-mares, and 53 young horses. At Ottenby, in Öland, there were 61 old and young stallions, 105 mares and fillies, and 8 geldings. There were also 7 stallions in Malmöhus län, and 5 in Christianstad, which had received Government premiums as stud animals.

The farm horses of Sweden are much lighter than those generally seen on English occupations; and although occasionally of considerable stature, they are frequently wanting in breadth and power. It is very rare to see more than two horses before a plough, or any other implement used for the cultivation of the soil; but, as already mentioned, the land is rarely if ever so strong as that of our stiff clays, while the severe frosts of the long winter penetrate to a great depth, and considerably lighten

the work of the farmer. The short period during which the land can be worked necessitates the keeping of a large staff of draught-animals, and the comparatively small draught-power attached to a plough, of course means, in many cases, comparatively shallow cultivation. On a very well-managed and characteristic farm of 1460 acres (360 being permanent pasture, and three-sevenths of the remainder in artificial grass annually), there were 34 horses and 28 oxen employed in working the farm, or more than $5\frac{1}{2}$ per 100 acres under cultivation. On a Norwegian farm, 500 feet above the sea, there were 8 horses to cultivate 130 acres of arable land in the short summer, but of course they were employed in the forests during the winter. On a farm of 360 acres, three-sevenths in artificial grass, in the south of Sweden, where the summer is much longer, there were 6 horses and 16 working oxen, or 6 draught-animals per 100 acres; while on another of 600 acres of arable land, also in the south, but with less artificial grass, there were 28 horses, or $4\frac{2}{3}$ draught-animals per 100 acres. The contrast presented by these last instances seems to suggest the well-known fact of the superiority of horses over oxen for farm-work.

The most instructive facts relating to horse-labour are those furnished me by Mr. Swartz, of Hofgården, who has 600 acres under the plough, over 500 acres in artificial grass left as long as possible, about 80 or 90 acres of permanent grass, and 500 acres of forest. Practically, the farm-work for the horses is confined to the 600 acres of ploughed land, on which there is no seed-course; but it is found necessary to keep 44 horses and 10 oxen, out of which 6 horses are employed in carrying water, milk, &c., leaving 48 draught-animals to work 600 acres, or 8 per 100 acres.* Mr. Swartz has everything weighed and measured, and every transaction carefully entered, an elaborate system of bookkeeping being thoroughly carried out by his clerks. Therefore, remembering that two years ago I somewhat startled the Farmers' Club by stating that it required as much land to keep a horse as would supply the necessary food for seven or eight men, I begged Mr. Swartz to give me his calculation of the quantity of land which was required to produce the food of each of his horses annually, taking average crops as the basis of calculation. This he did as follows:—The daily food of his horses consists of 10 lbs. of oats (8 lbs. crushed and 2 lbs. ground), 12 lbs. of hay, and 15 lbs. of straw per day, the whole year through. The average crop of 1 tunnland of

* This proportion is not larger than on other farms, except in the south, if the quantity of land which requires horse-labour in any one year be alone taken into the calculation.

oats is 1600 lbs.; of straw, 2400 lbs.; and of hay, 3000 lbs. Therefore the account is—

10 lbs. per day of	Oats	= 3650 lbs. ÷ 1600 lbs.	= $2\frac{1}{4}$	Tunnland.
15 lbs. „	Straw	= 5475 lbs. ÷ 2400 lbs.		
12 lbs. „	Hay	= 4380 lbs. ÷ 3000 lbs.	= $1\frac{1}{2}$	„
		Total	$3\frac{3}{4}$	„

The oats and the straw are thus taken as grown on the same land; and the total, $3\frac{3}{4}$ tunnland, is equal to exactly $4\frac{1}{2}$ imperial acres. The working oxen get 20 lbs. of hay, 15 lbs. of straw, and 2 lbs. of meal per day, or the produce of $2\frac{1}{2}$ tunnland of hay, $2\frac{1}{4}$ of straw, and $\frac{1}{2}$ of corn, or not very much less than the horses. If, to simplify the calculation, we take the whole of the draught-animals at the horse figure, then the produce of 216 acres of land is consumed by the animals which are found necessary for the cultivation of 600. Or, in round numbers, one-third of the crops go to feed the draught-animals employed in their cultivation. It may, however, be urged that all this should not be put to the debit of the farm, as the forest utilises part of the horse-labour in winter; but the important consideration from the agricultural point of view is that the work of the farm could not be done with fewer horses. Then again, Mr. Swartz has only 500 acres of forest, and in the winter his horses are occupied for six weeks in carrying firewood to the farm-steadings and labourers' cottages, and a portion of the remaining time in carting out manure. In the summer the men are up at six, and in the fields with their horses by seven, working until twelve. They resume at two, and work until eight, with an interval of half-an-hour between half-past four and five o'clock.

Posting Stations.—A sketch of the horses and horse-keeping of the Scandinavian Peninsula would be incomplete without some notice of the national and somewhat peculiar system of posting, which supplies the chief means of travelling in those districts where the railway has not yet penetrated. Theoretically, by law, the farmers of each defined district are bound to supply in turn, and at a fixed tariff, horses required by travellers, who may either order them beforehand by sending a messenger in advance (förbud), or may take their chance of finding horses at liberty at the successive stations. In the latter case, should there be no horse at liberty, and no other traveller in advance at the station, a horse must be furnished in one hour, two horses in two hours, and so on; but if the traveller is forestalled, he must wait patiently his turn, until the previous comers have been served, before the counting of his hours commences.

On most of the highroads, the stations, which are also the inns of the rural districts, are now let by contract to a post-

master, who takes the responsibility off the farmers by contracting to supply travellers, at the Government tariff, either with his own horses or with those which he may hire by private contract, in case of need, from such farmers or other persons as may be willing to let.

When driving in Dalecarlia (Dalarne) from Falun, I was unable to send my förbud papers, and I was therefore obliged to take my chance all along the route. At the first station, about 10 miles from Falun, there were two travellers before me, each of whom wanted one horse, therefore I was compelled to wait three hours before I could proceed another 12 miles on the road. By the time the second station was reached it had become too dark to proceed farther that night, so I had to resign myself to sleeping at this posthouse, which was fortunately much better appointed than the previous one.

French and German having proved of no avail, I was alike startled and relieved at hearing the postmaster's wife answer my forlorn-hope question, "Do you speak English?" with, "Waal, I guess I *dew* some," given with a pronounced Yankee drawl, flavoured with a Swedish accent. I secured her services as an interpreter in obtaining information as to the management of the station. Her husband receives a subvention of about 100*l.* per annum from the district, the contract being made for a period of five years. In return for this sum he is obliged to keep horses for travellers, and let them at the Government tariff, as follows:—

January	2 horses.	July	5 horses.
February	2 ,,	August	5 ,,
March	2 ,,	September	4 ,,
April	3 ,,	October	4 ,,
May	5 ,,	November	3 ,,
June	5 ,,	December	3 ,,

If additional horses are required at any time he is bound to get them at any cost within the stipulated time, and charge only the proper tariff to the traveller; therefore he actually keeps 12 horses all the year round, and is thus, generally speaking, independent of external aid.

That this contract is not unprofitable may be inferred from the fact that the postmaster is in his second term of five years, for which he has accepted a somewhat smaller subvention than he received during his first term.

I should add that this postmaster owns about 15 acres of land, which he cultivates in the usual manner, namely, fallow, followed by rye sown out with seeds, which remain 3, 4, or 5 years, and are succeeded by oats for 2 or 3 years. Sometimes six-row barley is taken instead of one of the crops of oats. Five

milch-cows and two or three young cattle are kept in addition to the horses, for which, of course, a large quantity of food is annually purchased.

Cattle.

In the far north a small white hornless breed of cattle (the *Finn ko*) exists, more or less in a state of nature; but I did not see any specimens of it. Prof. Nilsson has suggested that this breed may have descended from the extinct *Bos longifrons*, Owen.*

The only breeds that require description on economical grounds are the Thelemark breed of Norway, and the so-called Herrgårdsrace of Sweden, while the influence of crossing with foreign breeds, in enhancing the production of meat and milk, is even more important than the inherent capabilities of the native races.

Thelemark Breed.—With regard to this breed I cannot do better than quote the following description of it by my friend Mr. Tveter, the Manager of the Royal Farm at Ladegaardsöen, near Christiania, making only such alterations in verbiage and such omissions of detail as its publication in England seems to render desirable:—

"The Thelemark race is one of the few constant races of cattle, perhaps the only one, which Norway possesses. It is a well-defined mountain race, which, as its name denotes, has its home in Thelemark, and is found purest in the upper districts, Siljord, Hvideseid, &c.

"The animal is small. Full-grown cows rarely attain a greater weight than 660 to 770 lbs.; but it must be remarked that they increase considerably in size when put on better food than usual, particularly if this takes place at an early age. Thus on the Royal farm at Ladegaardsöen there are cows which, after having remained some years on good food, have attained a weight of 1000 lbs. and upwards. It is the usual scanty winter-feeding in Thelemark, in addition to early calving, which throws them back in their growth. In the summer—from Midsummer till the middle of September—the cows are kept in the mountain-pastures, where they usually have excellent grazing, but also frequently suffer much from cold and bad weather, as sheds are seldom erected for their protection. The great abundance of good summer-grazing often induces the keeping of more cows than can be properly fed during the long winter, for which reason the produce in milk is during that time extremely small; and in the spring the animals are usually lean, and in bad condition.

"The most remarkable points in the Thelemark breed are the slender form, small head, with long well-shaped horns (nearly always furnished with buttons), the sprightly movement, and the bright colouring. This last varies very much, from quite white till tolerably dark; but usually the variations are those of red, spotted and brindled. Most of the animals are red-sided, spotted, or dappled, but the somewhat rarer brindled colour is considered handsomer.† Besides the colour, the horns are very characteristic; hornless

* 'Annals and Mag. Nat. Hist.,' 2nd Series, vol. iv. 1849, p. 423.

† The colour is generally confined to the sides and head, the back and belly usually remaining white.—H. M. J.

('polled') cows are relatively rare, so that some people even maintain that such are not pure-bred. The horns should be long and slender, of transparent substance, regularly curved outwards, and a little forwards; a width between the tips of the horns of 24 to 30 inches is not of uncommon occurrence. The head must be small and fine; the eyes large and lively; the nostrils large, and the ears thin; the neck should be long, the body round, with straight back and broad hind-quarters. The milk-signs and the skin are naturally, in this as in every other milking race, of great importance.

"The Thelemark breed is peculiarly a milking breed. On the Royal farm at Ladegaardsöen the best milking cows have been of this race for the last three years, although animals of various breeds have been kept, and some rather large ones of 1000 lbs. living weight and upwards. The stock has therefore in the course of the last few years been changed almost exclusively to Thelemark cattle. Thus the cow 'Risöie' milked in 1868, 646¾ gallons; in 1869, 720 gallons; in 1870, 689¼ gallons, or on an average of 3 years 685½ gallons, with a living weight of about 790 lbs. English weight, that is nearly 9 lbs. of milk for each 1 lb. living weight annually, a result which bears comparison with the best foreign milking breeds.* Usually the Thelemark cows do not milk highly immediately after calving, seldom more than 3⅓ gallons daily, but they maintain the yield evenly, and do not remain long dry. It is also not usual that newly purchased animals give so rich a yield at first as afterwards; but yet we have instances of cows which have given above 3000 pots (637 gallons) in the first year. However, such instances do not justify the notion that so high a yield is according to rule among newly-purchased Thelemark cows;† it is naturally only in the case of exceptionally fine animals; usually we must be well satisfied when a cow weighing 660 to 770 lbs. gives 425 to 530 gallons of milk on regular good food.‡

"Like every other good milking breed, the Thelemark cows are very liable to milk-fever; for which reason it is very important to keep them on a low diet for some time before and after calving.

"The Thelemark breed has been improved during the last few years, by reason of the greater attention paid to the selection of breeding-stock, and by better keep. The State has caused a general exhibition of cattle to be held every autumn at Siljord, and this has been of great advantage to the district. Besides the prizes distributed and the lectures delivered, there has been formed spontaneously during the exhibition time a cattle-market, on rather a large scale in relation to Norwegian circumstances, where people from different districts of the country meet to buy and sell. Large herds are sent away every year, and the cows are distributed over nearly the whole country. Some animals have also gone to Sweden; and in 1869 His Majesty the King purchased six young animals, which are at Ulriksdal. One of these, which in the same year gained the first prize at Siljord, was an uncommonly fine animal.

"Some people were at first afraid that the race would degenerate in Thelemark, as many of the best prize animals were sold away; but it has been

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* A fallacy appears to lurk in this argument, which suggests that the annual yield of milk per lb. living weight is a correct standard of excellence. If this were true, a cow which made meat and milk concurrently would be regarded as unprofitable, in comparison with one that gave as much milk but became lean during the process.—H. M. J.

† According to the official statistics the average production of milk in 1865 (the date of the last Agricultural Census) was under 210 gallons per cow.—H. M. J.

‡ It order that it may not be thought that the above is an isolated instance, we refer to the report of Mr. Lindequist (Government Farm Superintendent) for 1866, in which 6 Thelemark cows from various districts are instanced which all gave more than 3000 pots in one year; one of them even 3584 pots (761 gallons).

proved, on the contrary, that year by year animals more worthy of the prizes come to the exhibition, naturally because the interest in better breeding is awakened, and people now can afford to feed better, the prices within the last twenty years having nearly doubled. The price of good animals varies now from 5*l.* 11*s.* to 6*l.* 13*s.* 6*d.*, and some few remarkable animals have been even sold for 11*l.* 2*s.* 3*d.* and upwards.

"The time as well as the place for the exhibition are judiciously chosen; in the middle of September the cattle return from the mountain-pastures, and those of most districts must pass by Siljord. Therefore thousands of animals pass through this place; some are driven past, but most of them stop at the place of exhibition; partly in order that some of them may be shown, but chiefly in order to sell. There is thus opportunity to make purchases in a short time, and, if requisite, of animals which are perfectly alike in shape and colour.*

"The greatest defect in the Thelemark breed is that the value of the animal to the butcher is very small. When a cow has to be slaughtered on account of age or accident the value of the meat is very little. The bulls are small and insignificant, and when put on good food become sluggish and unserviceable; so that it would seldom pay to purchase them for breeding. Ayrshire bulls have therefore been used successfully for crossing, and the mixed progeny has turned out extremely well. The cross does not gain anything in milking qualities, but usually retains the mother's structure with the greater fulness of body which distinguishes the Ayrshire breed, giving it a much higher value for the butcher. In Thelemark no mixture of strange blood is considered judicious, and therefore the prizes are only given for the pure breed; but for the agricultural districts the cross is to be recommended.

"While the Ayrshire breed, as well in Sweden as in Norway, has of late years fallen into discredit on account of its liability to tubercular disease, no symptom of such disease has hitherto, so far as we know, been observed in the mixed progeny. Such halfblood beasts have, at the Royal farm at Ladegaardsöen, attained a weight of 1100 lbs., and have been sold for 11*l.* 5*s.* to the butcher; while old Thelemark cows seldom fetch more than 5*l.* 12*s.* 6*d.* to 6*l.* 15*s.* As an instance of young Thelemark beasts having also had a fair value to the butcher, we may mention in May this year a five-year-old cow, weighing 850 lbs., and a three-year-old bull, weighing 990 lbs., were sold for export to England at 1*l.* 2*s.* 9*d.* per cwt. live weight."

In further elucidation of the characters and appearance of this breed I give overleaf a woodcut copy of a photograph of two of the prize cows at the last Gothenburg Agricultural Show, which were afterwards purchased by the King. Their diminutive size is well indicated by the stature and attitude of the servant.

It may be added that the export to Great Britain of animals of this breed is not likely to become extensive, as the expenses, which amount to between 2*l.* and 3*l.* per head, bear too large a proportion to their gross value, while the risk incurred by the voyage from Christiania to the ports of England and Scotland is so great that dealers express no inclination to increase the prices hitherto offered (see p. 219).

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* The exhibition was held in 1874 on Monday, 18th September. The road to Siljord is best *viâ* Skien, whence a steam-vessel plies through a pretty canal with locks up to the lake Nordsjö, from the upper end of which the traveller can post the same day to the exhibition. Thelemark is widely known for its natural beauties, and on that account is visited by a great many travellers every year.

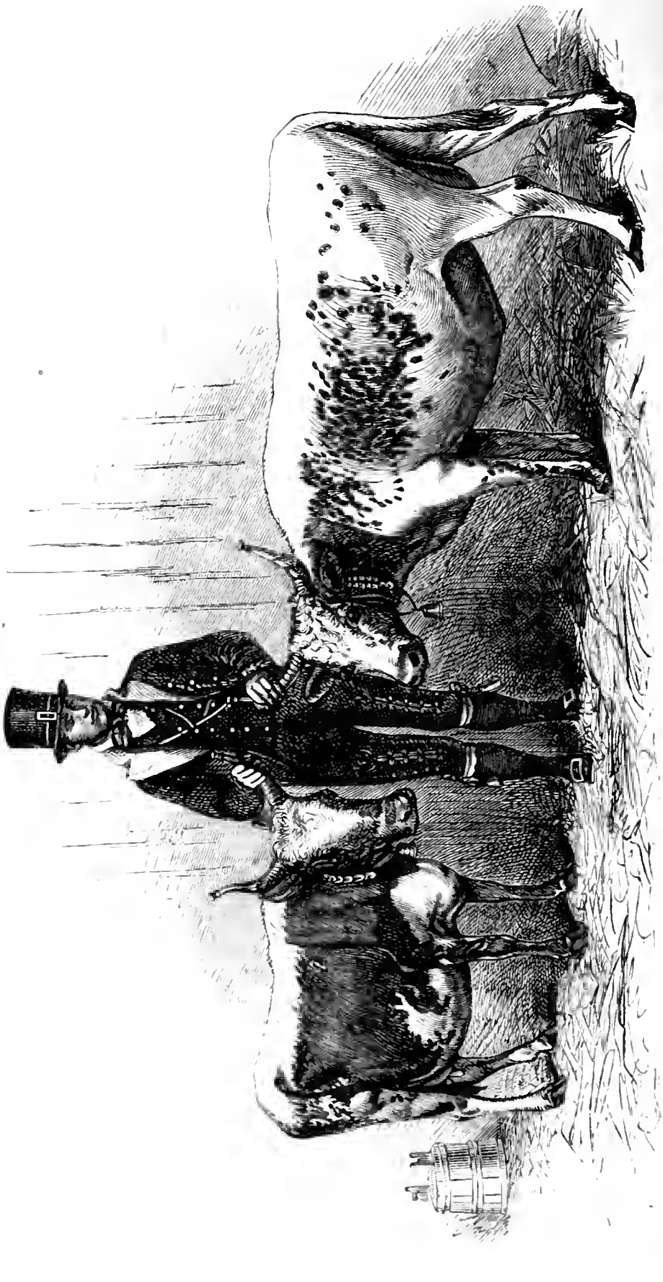
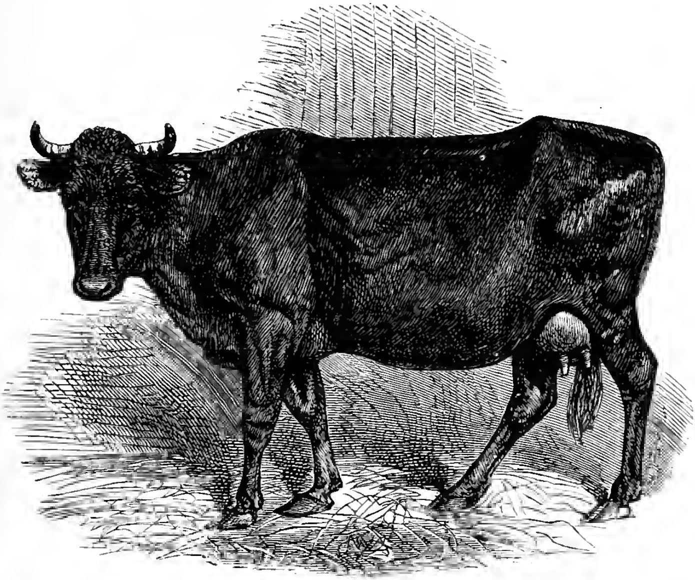


Fig. 7.—*Cows of the Thelemark Breed (from a Photograph).*

Swedish Country Breed.—According to popular tradition, this breed, now very variable in its characters, was introduced from Holland about 150 or 200 years ago. Mr. Dannfelt, however, assured me that they are a cross between the polled white race of the north of Sweden and some red cattle from Eckenforde, in Holstein, which were brought into Sweden by Swedish timber-merchants during the reign of Charles XI., *circa* 1680, and placed on the Royal estate of Strömsholm, where some are still to be found. Most of the country cattle are some shade of red, with a certain amount of white, especially about the face, but not so constantly as with our Herefords; the colour also varies from nearly yellow to a deep red. The best specimens are red with blackish points (see Fig. 8), in this respect resem-

Fig 8.—*Cow of the Swedish Herrgårdsrace (from a Photograph).*



bling the Angeln breed, as well as in being excellent milkers. I should also mention that the Rev. J. Storer, of Hellidon, Northamptonshire, having directed my attention to the value of pictures as indicators of the origin and history of cattle, I found some by Dutch masters of the seventeenth century, including one (No. 572) by Paul Potter, in the Stockholm Museum, which might well have been taken for portraits of the ordinary Swedish cows with white faces.

It is now very rare to meet with the Swedish cattle pure;

and on account of the difficulty of procuring good bulls, attempts at their maintenance as an improved pure breed have been practically abandoned. The best type is known as the *Herrgårdsrace*, or noble's race, a name which formerly distinguished it from the less-cultivated type that was bred by the peasants. The distinction is still maintained nominally, although it is now more a matter of feeding and general treatment than of pureness of blood, which it is almost vain to look for. Mr. Dannfelt has had one cow of the Herrgårdsrace which gave as much as 920 gallons of milk per annum, and others yielding from 575 to 690 gallons have not been uncommon on the Royal estates. At the same time it should be mentioned that peasants' cows do not yield anything like this quantity, from 200 to 300 gallons being a high average.

The ordinary system in Sweden, formerly more general than it is now, is that only the smaller farmers rear their cattle; and that as their heifers begin to breed they sell the older cows to the larger farmers. The peasant looks upon the sale of his cows as the principal source of his income in coin of the realm; therefore his object is to keep as many heifer-calves as possible. In the comparatively short summer there is generally plenty of food for them, but during the long winter they are half-starved. The people concerned have become so habituated to this mode of treatment, that they now, in very many instances, conscientiously believe it to be based on a rational system of cattle-breeding. They say, "if we fed the stock better during the winter they would run to meat like your Durhams." How far this treatment conduces to make them "run to milk" may be inferred from the fact that the annual yield of milk by peasants' cows is generally calculated at from 150 to 250 gallons, while not a few large herds of Shorthorn-crosses average 500 and 600 gallons per head per annum.

The prevailing system pays the large farmer well enough, because he buys cows, such as they are, at a time when they are beginning to yield the largest quantity of milk, namely, after having dropped two or three calves, at a price varying from 6*l.* or 7*l.* to 12*l.* or 14*l.*, according to circumstances, the highest prices being obtained in the neighbourhood of Stockholm and some other large towns for exceptionally good milkers. Universal testimony goes to show that the yield of milk may be enormously increased, even in cows that have been badly fed as calves and heifers, by a judiciously liberal diet; and it is scarcely conceivable that the cows could be reared by their purchasers at so small a cost as the price usually paid for them.

It will be seen by Table VIII. on page 195, that more than 60 per cent. of the cattle in Sweden, and more than 70 per cent. of

those in Norway, are milch-cows; and that in Sweden, of the remaining 40 per cent. 24 are young cattle, and only 16 bulls and oxen, the latter being chiefly used in the cultivation of the land. Thus the production of milk, and not of meat, is the great object of the Scandinavian farmer.

Following out the national practice a little farther, we find that nearly all the male calves are slaughtered as soon as they are born; and on the larger farms the female calves share the same fate, with the exception of from 8 to 10 per cent. where the herd is home-bred, to keep up the supply of cows in place of those which become barren, or are rendered unprofitable by reason of age. A few male calves are sometimes kept to be reared as working-oxen, and one or two for use as bulls.

The calves are frequently killed before they have suckled, but in some instances they are kept a day or two, and sold to butchers at prices varying from 5*s.* to 10*s.* per head, otherwise they are consumed on the farm. When a farmer has a superior breed of cattle, whether of the native or a foreign race, or a cross, he gets higher prices for his calves, both from farmers in his neighbourhood and those at a distance. In such cases, either a price is put upon the value of the animal when born, and a certain sum per day charged for its keep, or it is sold at a certain age at so much per pound live weight, without regard to the special qualities or excellencies of the individual animal.

Old cows of the native race are not often fattened for sale. Generally the attempt to fatten would be a failure, and if it succeeded would not pay. Working-oxen appear better adapted to the feeding process, and sometimes make up to about 1500 lbs. live weight, at from 8 to 10 years old. Many farmers get their working-oxen, as they do their cows, by purchasing them either direct from the peasants or at public markets, when 5 or 6 years old, at an average price of 14*l.* or 15*l.* each. These animals are bred by the peasants, and used by them until they become large and strong enough to fetch a good price.

As a rule, the calves are dropped at all times of the year; but the best farmers, unless they send their milk to a town, endeavour, if possible, to obtain cows that will calve soon after they are tied up for the winter, preferably about the beginning of November. Two reasons are usually given for this preference: in the first place, both milk and butter bring better prices during the winter; and in the second, it is said that cows which begin to milk soon after they go into the house, give one milking there, and a second when they are turned out to grass in the spring.

In Sweden, the cows are turned out about the beginning of June, and remain on the grass until the beginning of October, but the practice in such matters must necessarily vary with the

climate of the different parts of the country. Some farmers, especially those who sell their milk in a neighbouring town, keep their cows in the house all the year round; while others keep in only their best milkers. Feeding in the house involves a large amount of labour on the part of the cattle-men, and almost as much adjustment of the *ménu* as for a civic dinner. Cows are fed either two or three times a day, and milked during the progress of each meal, which lasts from 2 or 3 hours, in the latter case, to as much as 5 hours in the former. The following extreme examples are illustrative, the numbers denoting the "courses:"—A, (1) water, as much as the cows can drink, given in buckets; (2) 5 lbs. hay; (3) 2 lbs. bran mixed with chaff; (4) long straw. This allowance is given three times daily, and ½ lb. of linseed-cake is added to both the morning and evening meals. B, (1) 5 lbs. hay; (2) 5 lbs. beetroot-pulp, given at twice, after having been mixed with 2½ lbs. pea-straw; (3) cribs cleaned out and water given; (4) 4 lbs. cavings and 2 lbs. oil-cake; (5) 5 lbs. hay. Another meal of similar composition, but substituting an additional 5 lbs. of hay for the 2 lbs. oil-cake, is given in the evening. C, 20 lbs. of beetroot-pulp, 4 lbs. rape-cake, and 2 lbs. crushed oats, mixed together with cut straw, and divided into four equal portions. The cows are fed with this mixture four times daily, and, in addition, get long straw after the last milking.

Another example, taken from as far north as Gefle, shows that the cows there also get 15 lbs. of hay in the course of the day, as well as 15 lbs. of grains, 2 lbs. of oats, fermented by the addition of water to a mixture of those ingredients, and cut straw and cavings. The cows are fed three times a day, and each meal lasts from 2 to 3 hours.

Again, going to nearly the extreme south of Sweden, I find in my note-book that on an average good farm of 600 acres, the allowance of hay to each cow was 3000 lbs. for the winter months. It is important to draw attention to this matter, as it must have a considerable influence on the cost of production of milk, and the cost of rearing calves.

English Breeds and Swedish Crosses.—Specimens of various foreign breeds have been imported into Sweden from time to time, both by the Government and by private individuals, for the purpose of crossing with the Herrgårdsrace, as well as for the foundation of various herds. In the years 1848–50, Ayrshire and Pembrokeshire cattle were imported from Great Britain, as well as Allgäuer and Volkländer beasts from Bohemia. The Ayrshires were distributed throughout the country, and placed at Government stations, so as to facilitate their use for crossing with the country cattle in different parts of the kingdom. The experiment did not

succeed, as the breed was found to be generally subject, both in Sweden and Norway, to tubercular disease of the lungs. The Government herds were therefore sold off. Nevertheless, Ayrshires are still kept in most districts of Sweden; for although they cannot long stand the climate, it does not appear that their crosses with other races inherit this susceptibility to any great extent. Gradually, however, the Ayrshire is being displaced by the Shorthorn, the greater hardiness of which is now rarely contested.

At the date of the last returns, the following numbers of foreign cattle were at the several Government stations:—

	Shorthorns.		Allgäuer.		"Fjellrace," or Crossed with Allgäuer.	
	Bulls.	Cows.	Bulls.	Cows.	Bulls.	Cows.
Alnarp	2	31	..	..	..	..
Säbyholm	..	8	..	..	..	..
Sofiedal	..	..	3	18	..	..
Experimental Field, Stockholm	..	..	2	3	..	..
Rörön	..	..	..	..	1	10
Holm	..	..	..	..	..	10
Melderstein	..	..	..	..	1	10
Total	2	39	5	21	2	30

From this official return it appears that the Government has sold off all the English cattle, with the exception of the Shorthorns at the Agricultural College, at Alnarp, near Lund, and at the farm of Säbyholm, not far distant. The fact is, that the assistance of the Government is no longer needed in this matter, many English cattle being, when importation is not prohibited on account of cattle-plague, annually purchased through private channels, notwithstanding severe but doubtless necessary regulations, including three weeks' quarantine at the port, three months' isolation on the farm, and sundry inspections and certificates.

Shorthorns were first taken to Alnarp in 1862; and are now met with all over the south of Sweden. The common Yorkshire cattle are generally preferred to pedigree Shorthorns, as there is a prevailing idea that the use of the pure breed causes a diminished production of milk. There can be no question that most of the fashionable strains of Shorthorn blood would not pay to keep as dairy cattle; at the same time there is reason to believe that the almost universal dislike to pedigree bulls that

prevails throughout Sweden is founded more on prejudice than on practice. A few facts in illustration of the effect of breed in the production of meat and milk may be worth consideration by the dairy-farmers of both England and Sweden.*

Lieut. Hansen, of Gammalstorp, near Gråstorp, finds that the old peasants' cows cannot be fattened, and must be sold for next to nothing; while the Ayrshire cross will scale 1000 lbs. live weight, and fetch about 15*l.*, the market price having recently risen from 3*d.* to $3\frac{3}{4}$*d.* per lb.

Mr. Fogelmark, of Wall, near Gefle, has hitherto kept a cross of Swedish and Ayrshire, and has found their production of milk to average from 400 to 430 gallons per annum. The average yield of Swedish cows bought from peasants, even though well fed, does not exceed from 290 to 350 gallons per annum, while similar cows, with peasants' food, do not produce more than from 180 to 230 gallons of milk per annum.

Mr. Tranchell, at Säbyholm, near Landskrona, keeps East Friesland cows, and a cross of Shorthorn on the Holstein Marsh cattle. He finds that the former give an average of about 575 gallons of milk per annum, and the latter an average of only 460 gallons; but on the other hand, the greater adaptability of the cross to fatten makes the total result about the same. Both varieties yield most milk when the cows are about 8 years old; but they do not keep the cross-bred cattle so long as the East Frieslanders before fattening them.

Count von Platen, at Kulla Gunnarstorp, keeps a cross of Ayrshire and East Friesland. The cows give an average of 460 gallons of milk per annum, and are sold lean when no longer profitable in the dairy.

Professor Nathorst's results with pedigree Shorthorns and Yorkshire cows, at the Agricultural College at Alnarp, are given on page 212.

Mr. Swartz, of Hofgården, who began with Swedish cows in 1856, at first decided to sell off all that did not yield an average of 200 gallons per annum; he now keeps a cross of Shorthorn on the Swedish Herrgårdsrace, and has an average milk-return of 460 gallons per head, selling off all cows that do not yield over 400 gallons per annum. This cross nicks remarkably well, the produce being larger, age for age, than either of the parent breeds. The calves are generally sold at 4 months old, on the following system:—a sum of 11*s.* 3*d.* (10 rd. Swedish) is charged for the calf when born, and $2\frac{4}{10}$*d.* (20 öre Swedish) per lb. live

* On this point Lady Pigot has given some interesting examples in an 'Extract from a Chapter addressed "To the Small Farmer,"' from a work about to appear, but in the mean time published as an appendix to the 'Private Catalogue' of her Shorthorn herd for 1874.

weight at the time of sale. At four months old the heifer-calves weigh from 300 to 340 Sw. lbs., and the bull-calves from 340 to 400 Sw. lbs.; the prices will therefore vary between 3*l.* 17*s.* 6*d.* and 5*l.*

Mr. Axel Dickson, of Kyleberg, near Wadstena (whose farm will presently be described in detail) breeds nothing but Shorthorns, though he purchases young cattle for feeding purposes, chiefly of the Shorthorn-Swedish cross. He finds that the average production of milk by his Shorthorn herd is nearly 520 gallons per head per annum.

The preceding details, selected as among the most precise and illustrative cases of which I took notes, show that the native Swedish cows kept by the peasants on poor food produce only about 200 gallons of milk per head per annum, and that the old cows are worth very little as beef; that by better treatment the same kind of cow may be brought to produce at least 50 per cent. more milk, while a cross of Ayrshire will not only double the first-mentioned milk-production, but give a butchers' value to the old cows. The result of crossing the native breed with Shorthorns is still more favourable, both for meat and milk; and Mr. Tranchell's experience leads him to value the adaptability to fatten,* which an infusion of Shorthorn blood confers, at not less than 100 gallons of milk per annum.

Management of Shorthorns in Sweden.—The details of the management of a Shorthorn herd in the climate of Sweden will doubtless be read with interest by Shorthorn breeders in the United Kingdom; and although the selected locality, Alnarp, is in the favoured province of Scåne, the method pursued there shows that the Shorthorn is by no means too delicate an animal to be reared in provinces much further north.

At the time of my visit last autumn, the Shorthorn herd consisted of about 40 females, most of them bred from animals which had been purchased in England, and evidently selected for their dairy qualities. Six cows and heifers by the Gwynne bull "Macdonald," had been obtained from the herds of Mr. Thomas Morris, of Maisemore Court, Gloucester, and four cows and heifers from that of Mr. Hewer, of Sevenhampton, Wilts. The former, bred from the old Strickland herd, has of late years been kept up with Bates blood; while the latter has been bred chiefly from Booth strains. Both are, however, very celebrated in the south of England as excellent dairy herds

* What was meant to be understood was no doubt the general power of assimilating and utilising food, which is made most manifest in Shorthorns and their crosses by their adaptability to fatten in a short time and on comparatively small quantities of food.

of pure Shorthorns, and Mr. Morris's cattle especially have done remarkably well in Sweden.* Two heifers had also been bred by Mr. Stiles Rich, whose herd in Gloucestershire was well known for its Bates blood and dairy qualities. There were also two cows of Mr. Pawlett's breeding, and two of Mr. Hugh Aylmer's, both these herds being of Booth blood. The sires selected for use were the Bates "Third Baron Westbury," of the Wild Eyes tribe, bred by Mr. Thomas Bell; "Macdonald Second," from Mr. Morris's herd; and "Prince of Athens," from Mr. Barber, combining the Towneley and Booth strains.

The herd at Alnarp also includes eighteen Yorkshire dairy cows, some from Mr. Hutchison's herd at Catterick, and about sixty Swedish and other cows, for dairy purposes.

Commencing with bull-calves, these get milk until they are six months old, namely, whole-milk for the first two months, commencing with $1\frac{3}{4}$ gallon per day and gradually increasing to double the quantity; after the age of two months the whole-milk is gradually mixed more and more with skim-milk; and when they are from three to four months old they get only skim-milk, and as much linseed-cake and crushed oats as they care to eat, both given dry. The heifer-calves are not allowed milk-diet for more than four months, half the time being kept entirely on whole-milk, and eventually on skim-milk, supplemented by crushed oats and linseed-cake. After they are six months old the diet of all the calves consists of hay, 2 lbs. of linseed-cake, and from 2 to 4 lbs. of oats. It has not yet been found necessary to seton them, as no indications of quarter-evil have been noticed.

Calves are kept entirely in the house when quite young, but after nine months old they are kept out of doors day and night, except in the winter months.

The cows, in winter, are fed with a mixture consisting of half a bushel of pulped mangolds per head, and as much cut oat and barley-straw as they can eat, together with 1 lb. of rape-cake. The mixture is left to ferment for forty-eight hours, and is given in two meals, one in the morning and the other in the evening. In addition to this mixture their daily food consists of 2 lbs. of linseed-cake, 4 lbs. of oat or barley-meal, and 10 lbs. of hay, likewise given in two meals in the cribs, with a little water, before the fermented mixture. A little meal is generally reserved to dust over any remnant of the mixture, and thus induce the cows to finish it. It is considered that the small quantity of

* In her published 'Extract,' &c., already quoted, Lady Pigot mentions this gentleman's herd as consisting of 106 pedigreed cows—"animals that would supply the dairy and the butcher afterwards,"—besides about fifty common-bred cows.

rape-cake gives a better flavour to the butter, but that more than 1 lb. per cow daily must not be given.

In the summer the cows are kept in the byres during the earlier months, getting green clover or a mixture of oats, tares, peas, and barley (cut green). The heifers are never soiled, as they would not be so hardy under that treatment; they are, therefore, turned out of doors as early as the season will permit, generally some time in April.

Shorthorn heifers have hitherto been very rarely sold, as they are required to increase the proportion of pure Shorthorns in the herd. Bull-calves of pedigree descent are generally sold to Denmark, the ordinary price being about 8 guineas per head at the time of birth, and 1 rd. (1*s.* $1\frac{1}{2}$*d.*) per diem afterwards for keep. Of course, special prices are asked in the case of extra good animals. While the pedigree Shorthorns are preferred in Denmark, the farming of which is nothing if not dairying, it is remarkable that in Sweden very few people will look at anything more "pure" than the Yorkshire dairy cross. This accounts for Professor Nathorst keeping both classes of stock. His legitimate object is to provide for the wants of his customers, and he is not responsible for their taste or their wisdom.

The average production of milk at Alnarp per cow, per annum, is for pure Shorthorns 500 gallons, but some of the best cows have given double that quantity, and Yorkshire cows an average of 800 gallons; the price obtained for butter is, according to contract, fixed at rather more than 5*s.* per cwt. above the highest price quoted in the 'Berlinske Tidende' at the time of sale.

Professor Nathorst informs me, as the result of numerous experiments, that in order to get good milking cows of the pure Shorthorn breed, it is necessary to keep them rather poor as heifers, and to bring them early to the bull. This treatment, however, reduces their size and weight, and the cows will never grow so large as their mothers. On the other hand, if the object be to rear meat-producing animals, then, by keeping them well as calves and heifers, and not putting them to the bull until 22 months old, they can rear Shorthorns as large and as heavy at the same age in Sweden as in England; and under such treatment the breed shows no sign of degeneration.

Some further information on Shorthorns, chiefly as meat-producing animals, is given in the account of Mr. Axel Dickson's farm at Kyleberg (p. 231).

Tondern Breed.—This is a Danish breed that has found considerable favour in Sweden, especially with the occupiers of heavy land; as the male animals, on account of their large size and great weight in comparison with the Swedish, furnish good draught-oxen. It will be more particularly described in my

succeeding report on Denmark; therefore at present it is sufficient to state that it is a red breed, equally adapted for the production of milk and of meat, but not attaining special excellence in either respect.

The average production of milk reported by Mr. C. Ekman, of Finspong, as that of his well-kept Tondern herd, is 460 gallons. The lean cows weigh, on an average, nearly 10 cwt.; both they and the working-oxen are easily fattened, and then fetch nearly the same price, without distinction of sex.

In the summer Mr. Ekman's cows pasture either in the meadows or on the aftermath of the artificial grasses. In the winter they each get per diem from 9 to 11 lbs. of hay, 4 lbs. of crushed oats, 1 lb. of oilcake, and straw.

TABLE IX.—FOOD LIST for CALVES on FISKEBY and SKÄLF ESTATES.

Week.	Day.	Milk. Morning.	Milk. Noon.	Milk. Evening.	Linseed-Meal.	Barley and Pea-meal.	Oatmeal.
		Gallons per day.			Pounds Avoirdupois per day.		
1	1	..	..	0·14*	..	..	..
	2	0·14	0·14	0·29	..	..	..
	3	0·29	0·14	0·29	..	..	..
	4	0·43	0·14	0·29	..	..	..
	5	0·43	0·14	0·43	..	..	..
	6	0·58	0·14	0·43	..	..	..
	7	0·58	0·14	0·58	..	..	..
2	..	0·58	0·29	0·58	0·24†	..	..
3	..	0·72	0·29	0·58	0·47	..	..
4	..	0·72	0·29	0·43	0·71	..	..
5	..	0·87	0·29	0·72	0·94	0·24	..
6	..	0·87	0·29	0·87	1·18	0·47	..
7	..	0·87	0·29	0·87	1·41	0·71	..
8	..	0·87	0·29	0·87	1·88	0·94	..
9	..	0·87	0·29	0·87	1·88	1·18	..
10	..	0·87	0·29	0·72	1·88	1·41	..
11	..	0·72	0·29	0·72	1·65	1·65	..
12	..	0·72	0·29	0·58	1·41	1·88	..
13	..	0·58	0·29	0·58	0·94	2·12	..
14	..	0·58	0·29	0·43	0·71	2·35	..
15	..	0·43	0·29	0·43	0·47	2·59	..
16	..	0·43	0·29	0·29	0·24	2·82	0·24
17	..	0·29	0·29	0·29	..	2·82	0·47
18	..	0·29	0·29	0·14	..	2·82	0·71
19	..	0·14	0·29	0·14	..	2·82	0.94
20	..	..	0·29	..	..	2·82	1·18

NOTE.—The linseed is given ground, and mixed with warm water and the milk.

From eight to ten calves are annually kept to take the place of unprofitable cows, the remainder (about thirty-four) being easily

sold to neighbouring farmers. The preceding tabular statement of the quantity of food given to calves for the first twenty weeks after birth is instructive, both for the actual information it contains and as another illustration of the precision with which such matters are dealt with not only in Sweden but also generally throughout Northern Europe. I must confess, however, that although such returns excite my admiration as supplying precise data for statistical calculations, I am somewhat sceptical as to whether the method which they represent, supposing it to be rigorously followed in practice, enables the stock-breeder to obtain the best result from his animals—whether, in fact, the appetite and the assimilating power of every calf are exactly the same at the same age, on the principle that tubs or steam-boilers of the same dimensions must have the same capacity!

Cost of rearing Calves.—The almost universal practice in Sweden of killing, generally for home consumption, nine-tenths of the calves as soon as they are born, prompted me frequently to ask the reason. The answer invariably was, that "it did not pay to rear them." It was urged that the milk was wanted either for sale or for making into butter or cheese—commodities that are always marketable, and that could be sent long distances at an expense small in proportion to the value of the article, with little or no risk of loss from damage, detention, &c. In the north of Sweden, also, the long winter renders the winter fattening of cattle very costly, and there is thus little demand for young stock to be reared with that object; but were it otherwise, the cost of transport would bear too large a proportion to the value of the animal, while, owing to the paucity of itinerant dealers, the risk of loss by deterioration of value, or by death, would be too great to make the venture sufficiently attractive.

It must be admitted that there is a great deal of force in these arguments; and until the present movements in favour of improved breeds of cattle and improved means of communication have had more time for their development, no great difference in the methods of stock-farming at present pursued in Sweden and Norway can be expected. Another obstacle, in addition to those in course of removal, is the want of a certain demand for store stock at remunerative prices; and this cannot be overcome until the common cattle of these countries have been extensively crossed with Shorthorn blood, or superseded by animals better adapted for feeding purposes. At the same time, it may also be remarked that, in districts which are in direct railway communication with the larger towns and the principal ports,

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* One-fourth of a kanna, and so on.

† One-fourth of a Swedish lb., and so on.

cattle-feeding is on the increase, not only in connection with sugar-factories, distilleries, and breweries, but also on farms where the growth of roots has recently been extended.

It would have been presumption in me to doubt the conclusions of so many practical Swedish farmers with reference to the rearing of calves, especially as two circumstances suggested that the process must be much more expensive in Sweden than in England. The first of these was, again, the long winter. There many, perhaps the majority, of the calves are born between November and March, and must necessarily be kept in the house until June, while it is the prevailing practice to keep all the young cattle in the sheds during the first summer, and until after the second winter, during the whole of which time their food consists largely of hay, which, in comparison with its nutritive and manurial power, is very expensive keep. On the other hand, as cheese or butter is made on nearly all the farms in question, it seemed to me that calves would pay as well as pigs for feeding on dairy-refuse. In any case, I was anxious to obtain an actual account of the cost of rearing calves from some reliable source, and I was so fortunate as to obtain the following statement (p. 217) from that mine of valuable records, Mr. Swartz, of Hofgården, which I publish with his permission.

This statement is valuable, as showing what Mr. Swartz has calculated to be the cost of rearing a heifer, on his farm, until it produces its first calf, at 25 months old, on the basis of the money-value of the different farm-products used as food, which he has deduced from a series of observations and records, extending over many years, as the amount which they severally bring in, on the average, as dairy produce, after deducting the cost of manufacture.*

It will be observed that new milk is calculated at less than 6*d.*, skimmed-milk at a little over 2*d.*, and whey at ½*d.* per gallon. The value of hay is put at the low sum of 33*s.* 4*d.* per ton, cavings at 22*s.* 6*d.*, straw at 16*s.* 8*d.*, and roots at 13*s.* 4*d.* The 70 days' grazing is valued at no more than 1*l.* 7*s.* 10½*d.*, although it occupies about half the growing season of grass in that part of Sweden. Notwithstanding these low prices, the calculated value of the food consumed by a two-year-old heifer in Sweden comes to about double the estimated cost of rearing one in England. This is partly owing to Mr. Swartz's table being based on the estimated value of the food, instead of the

* Inasmuch as it is almost impossible to give the exact equivalent of every item of Swedish money in English coin, I have given the original figures and my approximate translations of them. The English totals are re-calculated from the Swedish at the rate of 18rd. to the sovereign, and must be taken as approximately accurate, even though they should differ slightly from the summing up of the English column.

Table X.—Mr. Swartz's Calculations of the Quantity and Value of the Food of a Heifer from Birth until it Produces a Calf at Twenty-five Months old.

	Rd.	*öre.*			£	*s.*	*d.*
Value of calf at birth	10	0	=		0	11	1½
First 4 months' feeding:—							
45 kannor new milk, at 25 öre ..	11	25	=	26 galls., at 5⅞*d.*	0	12	8
511 ,, skim milk, at 9 öre ..	45	99	=	294⅓ galls., at $2\frac{1}{10}$*d.* ..	2	11	6
2·66 centr. hay, at 1 rd. 25 öre ..	3	33	=	2⅕ cwt., at 1*s.* 8*d.* ..	0	2	8
2·66 centr. straw, at 62½ öre ..	1	67	=	2⅕ cwt., at 10*d.*	0	1	10
Cost at 4 months .. Rd.	72	24	=		4	0	3
Second 4 months' feeding:—							
360 kannor skim milk, at 9 öre	32	40	=	207⅓ galls., at $2\frac{1}{10}$*d.* ..	1	16	3⅗
12 centr. hay, at 1 rd. 25 öre ..	15	00	=	10 cwt., at 1*s.* 8*d.* ..	0	16	8
3·60 centr. straw, at 62½ öre ..	2	25	=	3 cwt., at 10*d.*	0	2	6
9·60 centr. roots, at 50 öre ..	4	80	=	8 cwt., at 8*d.*	0	5	4
Cost at 8 months .. Rd.	126	69	=		7	0	10
Third 4 months' feeding:—							
480 kannor whey, at 2 öre ..	9	60	=	276 galls., at ½*d.* ..	0	11	6
18 centr. hay, at 1 rd. 25 öre ..	22	50	=	15 cwt., at 1*s.* 8*d.* ..	1	5	0
3·60 centr. cavings, at 83⅓ öre ..	3	00	=	3 cwt., at 1*s.* 1½*d.* ..	0	3	4½
3·60 centr. straw, at 62½ öre ..	2	25	=	3 cwt., at 10*d.*	0	2	6
19·20 centr. roots, at 50 öre ..	9	60	=	16 cwt., at 8*d.*	0	10	8
Cost at 12 months .. Rd.	173	64	=		9	13	0
Fourth 4 months' feeding:—							
480 kannor whey, at 2 öre ..	9	60	=	276 galls., at ½*d.* ..	0	11	6
18 centr. hay, at 1 rd. 25 öre ..	22	50	=	15 cwt., at 1*s.* 8*d.* ..	1	5	0
3·60 centr. cavings, at 83⅓ öre ..	3	00	=	3 cwt., at 1*s.* 1½*d.* ..	0	3	4½
3·60 centr. straw, at 62½ öre ..	2	25	=	3 cwt., at 10*d.*	0	2	6
38·40 centr. roots, at 50 ore ..	19	20	=	32 cwt., at 8*d.*	1	1	4
Cost at 16 months .. Rd.	230	19	=		12	15	9
Last 9 months' feeding, viz. first 200 days:—							
40 centr. hay, at 1 rd. 25 öre ..	50	00	=	33⅓ cwt., at 1*s.* 8*d.* ..	2	15	6½
6 centr. cavings, at 83⅓ öre ..	5	00	=	5 cwt., at 1*s.* 1½*d.* ..	0	5	6½
6 centr. straw, at 62½ öre	3	75	=	5 cwt., at 10*d.*	0	4	2
64 centr. roots, at 50 öre	32	00	=	53⅓ cwt., at 8*d.*	1	15	6
2 centr. meal, at 6 rd.	12	00	=	1⅔ cwt., at 8*s.*	0	13	4
Last 70 days on grass	25	00	=		1	7	10½
Total .. .. Rd.	357	94	=		£19	17	8

cost of its production, and partly to the expensive Swedish system of feeding young cattle during so long a period in the house, and therefore to so large an extent on hay. Both in England and in Sweden, the cost of rearing a two-year-old heifer is subject to a deduction on the score of the manure made in the house. According to the foregoing Table, the value of this would be about double its worth in England, the estimated manurial value of the hay alone being, according to Mr. Lawes, no less than 5*l.* 16*s.* (76 cwt. at 1*l.* 10*s.* 6*d*), even if reckoned as meadow-hay instead of artificial grass; while the straw, cavings, roots, and meal would add at least another 30*s.* to the estimated value of the manure.*

Exportation of Swedish Cattle.—Gothenburg is the chief port from which cattle are exported from Sweden to England. They are chiefly oxen, but cows and calves are also sent. Arriving in Gothenburg, whether by rail or road, they are either put into the public lair, near the railway station, apparently a very well managed establishment, or they are taken to the private lairs belonging to the exporters, which are situated some distance from the town. The principal exporter has a lair in which he can put up 300 head of cattle. When kept in the public lair until it is time to ship them, the exporters pay about 3½*d.* per head of cattle per diem for lairage, and extra for food according to the season. In 1873 the charge for this item was about 10*d.* per head per day, but in the following year it was nearly double. On the voyage the cattle get a little hay and water, the latter, I was informed, being rendered necessary by the imperfect ventilation of the steamboats. I cannot avoid taking this opportunity of reiterating my opinion that all such steamers should be compulsorily furnished with blast-fan ventilators, driven by steam from the ordinary boiler. I have shown in my Report on the "Trade in Animals,"† that such appliances are easily added to existing steamers, and are at the same time cheap and effective.

The commission-agent in Gothenburg is appointed by the Agricultural Society of the district, to which he gives a guarantee-bond of about 2750*l.*, while the Society guarantees to the exporter the money which his beasts realise when sold. I was informed that the commission-agent is not allowed to charge the exporter more than 2*s.* 3*d.* per head of cattle, and about 6¾*d.* per head of sheep or pigs. The freight and other charges from

* Lady Pigot quotes figures furnished her by Mr. Hugh Aylmer, of West Dereham Abbey, showing that the cost of bringing up a Shorthorn steer (by a pedigree bull out of a common bred cow), and *fattening it off* at two years old, is 35*l.* 13*s.* 8*d.*, subject to a deduction of 7*l.* for value of the manure, and of 3*l.* for milk of cow for three months after the calf was weaned, leaving a net cost of 25*l.* 13*s.* 8*d.* *Vide op. cit.*, pp. 64 and 65.

† 'Journ. Roy. Agri. Soc.,' 2nd Series, vol. ix. part 1, p. 235. 1873.

Gothenburg to the cattle-market at Islington amount to 37*s.* per head, exclusive of insurance; therefore the total expenses need not much exceed 2*l.* per beast.

With regard to the quality of the cattle which have hitherto been sent to Great Britain from Sweden and Norway, I have been so fortunate as to obtain the opinion of Messrs. Swan and Sons of Edinburgh, contained in the following extract from a letter to me, dated June 30th, 1874. It is only necessary to preface this extract by stating that Messrs. Swan and Sons have as large a trade in cattle with the European Continent as any firm in the British Isles, and that their statements are entitled to the weight due to the results of long and extensive experience.

"*Norway.*—In 1858, one of this firm was commissioned to go out to buy cattle, a vessel being sent from Leith on the recommendation of the at that time Professor of Agriculture in Norway, the owner commissioning us to fill her with cattle, and resell them here on his account. After travelling through a large tract of country from Bergen inland, the cattle were found of so inferior a breed—bulls, cows, and heifers being grazed indiscriminately—and the stock, *never originally of a good class*, were so diminutive and unsuitable, that he returned with *one cow* as a sample. The Norwegian cattle, so far as we have had them, are much like the Shetland breed, therefore so long as they maintain the present breed in its purity, they are not calculated, either as stores or fat, to afford this country any source of supply; the best we have had this year from Christiania have averaged about 14*l.* a-piece, fat, and these our consigners intimated were first-class quality. So long as the system of in-and-in breeding is allowed, they are likely to get worse in place of better, and, judging from our experience, there has been no general improvement amongst Norwegian cattle since 1858.

"*Sweden.*—From this country we get the best and the worst cattle sent us from the Continent. The native yellow bullocks, which come from Gothenburg and Malmö, are, as a rule, plain, and sell very large for the money. With, in some seasons, a scarcity of home-bred store stock, some of our farmers have been induced to buy them in the autumn for fattening; these have generally done wonderfully well on turnips, but their natural roughness, even at small prices, prevents our farmers, as a rule, from buying them. There are, however, many prime fat cattle, Shorthorn crosses, now raised in Sweden, which, sent here fat, make close on home-fed cattle quotations.

"Were good Shorthorn bulls introduced amongst those districts where cattle are bred, this country could supplement our own want of store cattle, as the native breeds have size and hardihood, and they would also be very materially improved in symmetry.

One of our firm, lately in Aarhuus, at the Jutland Fat Cattle Show, met a Swedish Professor who advocated the advantage of Shorthorns being imported into Sweden. The ordinary run of Swedish bullocks make from 14*l.* to 18*l.* or 19*l.* each, though some old work-oxen occasionally reach 30*l.*, and even more, when stall-fed in their own country; while crossed-Shorthorns from the same country make, as three-year-olds, 22*l.* to 32*l.* each. From Sweden therefore, by judicious Shorthorn-crossing, a large supply of first-class fat cattle, as well as useful and saleable stores, might readily be available.

"At present we have large lots of calving-cows, which are readily bought by Edinburgh dairymen,—foreign cows constituting the whole stock in some dairies in the city. These make prices varying from 7*l.* to 15*l.* each, as a rule milk well, and from their small cost are less risk to the dairyman; while when fat they frequently make 3*l.* to 5*l.* a-piece over inlaid price, Ayrshires or Shorthorns generally losing nearly as much comparatively between purchase by the dairyman and sale to the butcher. The cross in this class of stock, therefore, would likewise be beneficial, many of our best dairymen refusing them at present from the same cause as the farmers do the store cattle of the native breed."

Sheep.

Although every farmer keeps a few sheep, sheep-farming, as we understand it, scarcely exists in Sweden and Norway. The few sheep or goats seen on even the smallest farm are kept more for domestic use than as a source of profit, more for the wool than the meat, and in some districts, as in Dalarne, chiefly as the source of supply of the sheepskin jacket, which is part of the national costume of both men and women.

The province of Scåne, in the South of Sweden, is the only district in which large flocks of sheep are frequently met with on arable land; but even there almost every farmer whom I questioned on the subject told me that formerly he kept more sheep, that they did not pay, and that he had reduced his flock. The fact is, sheep are an expensive stock to feed, and a troublesome stock to look after during the long winter, and therefore good sheep-farming is most frequently to be seen in that part of the country where the winters are neither so long nor so severe as in the more northern districts. In Sweden, as in Canada, sheep cannot find a large, or even any, portion of their winter food for themselves on the pastures, as they do in England, and on that account must be less profitable than in this country.

The sheep-management at Säbyholm, near Landskrona, may be described as an example of the better class: 50 Cotswold

ewes and 100 Southdowns are kept, the latter breed being preferred, although they do not clip so much wool, partly because short wool meets with a readier sale, and partly because the Southdown lambs are more easily reared. The ewes are tupped on seeds, about the middle or end of September, and go into winter-quarters about the end of October to the middle of November, according to the season, when they get pea and bean-shucks, and long straw with cut turnips. When the lambs drop in March, the ewes are still in the house, and they then receive $\frac{1}{4}$ lb. linseed-cake each, with some hay, in addition to their previous food. As soon as the lambs will eat, they are given peas that have been soaked in water, with a little linseed-cake and fine hay; but they get no additional food at weaning-time, which is generally about the beginning of June.

When the lambs are weaned the ewes are shorn; the Southdowns are clipped once a-year, and the ewes give an average of 4 lbs. each; but the Cotswold ewes give from 7 to 8 lbs. each in two clips, viz., in June and October. In the summer the sheep-stock is kept on seeds without artificial food.

At one time, Mr. Tranchell, the proprietor of Säbyholm, had a flock of 800 sheep, but finding that they did not pay, he reduced the number to 300, one-half being breeding-ewes. I endeavoured to learn how it had been ascertained that the sheep did not pay, and found that they had been debited with all actual expenses and credited with all actual receipts, except that they had received credit for the value of only 3 months' manure; the remainder, probably that dropped about the fields, not being capable of collection and valuation, had been passed over as worthless. Then what is the value of the "golden hoof" in Sweden?

Very rarely can a true Swedish sheep be now seen in the southern provinces of the country, as they have all been crossed for several years with English Southdowns, Cotswolds, or Leicesters, and more rarely with French Merinos. The value of good rams may be measured by the fact that Professor Nathorst, at Alnarp, gets about 5*l.* 10*s.* per head for his Southdown and Leicester tups when 18 months old. He sells his draft-ewes at 3½*d.* per lb., live weight.

Pigs.

Almost every farmer in Sweden and Norway keeps pigs to consume the refuse products of the dairy. A few, however, say that they have been compelled to abandon them on account of their liability to measles and scarlet-fever. Many Swedish farmers, according to Mr. Juhlin Dannfelt,* are now

* 'Journ. Roy. Agric. Soc.,' 2nd Series, vol. viii. part 2, 1872, pp. 273 and 274.

feeding calves with skim-milk, instead of making skim-cheese and feeding the pigs on the whey. I have already stated (p. 216) that this practice is adopted by Mr. Swartz, of Hofgården; and doubtless, as markets for good horned-stock become more accessible, it will be considerably extended.

The pigs generally seen on Swedish farms are crosses of the large Yorkshire or Cumberland breed on the original Swedish; but sometimes Berkshire crosses are seen, and occasionally, as an *article de luxe*, a specimen of one or other of our smaller breeds.

Dairy-farmers who make whole-milk cheese, and devote a considerable quantity of corn as well as all the whey to the manufacture of pork, may turn out half as many fat pigs in the year as they have dairy-cows. Comparatively few farmers, however, reach this proportion, as they either sell part of their milk, make butter and skim-cheese, rear a certain number of calves, or, most generally, have not sufficient corn to fatten pigs as well as keep their horses and cattle throughout the winter. The usual allowance of corn for feeding pigs is from 2 to 3 lbs. each per diem, in addition to whey, wash, potatoes, &c., for about a couple of months before they are sold. When sold, they generally weigh from 200 to 240 lbs., live weight, and from $3\frac{1}{2}$*d.* to 4*d.* per lb.

Dairying.

Two admirable articles on Swedish Dairying, by our honorary member, Mr. Juhlin Dannfelt, have already been published in this Journal;* and to them I would refer every one interested in the subject, if they wish thoroughly to understand the manner in which this branch of agricultural industry is carried out in a northern climate. It is unnecessary for me to go over the ground that has thus been so thoroughly explored by Mr. Dannfelt, viz., the small-farm dairying, and the manufacture of cheese and butter at factories under different systems of co-operation. I shall therefore restrict myself to a rapid glance at the dairying of large farms, under the three aspects of, (1) sale of milk to towns, (2) butter-making, and (3) cheese-making.

Sale of Milk to Towns.—The price obtained for milk sent to large towns varies from 25 öre per kanna = $5\frac{7}{8}$*d.* per gallon, in the summer months, in the south of Sweden, to 40 öre per kanna = $9\frac{3}{8}$*d.*, at Gefle, in the north. In the winter the price in the south rises to 29 or 30 öre per kanna, equal to about 7*d.* per gallon. It is not usual for the farmer to deliver the milk. The milkman purchases it for a stipulated price on the spot, and the

* 'Journ. Roy. Agric. Soc.,' 2nd Series, vol. vi. part 2, 1870, p. 323, and vol. vii. part 2, 1872, p. 267.

farmer agrees to place at his disposal one, two, or more horses, and a cart or two, according to the quantity of milk to be delivered. Lodging accommodation and wood are also furnished to a stipulated number of servants employed by the milkman.

Butter-making.—Scandinavian butter has of late years acquired a very high reputation, chiefly owing, I believe, to the ice-water system of setting milk, which was discovered by Mr. Swartz, of Hofgården, near Wadstena, the gentleman who has already been so frequently referred to in this Report. Deep cans nearly full of milk are placed in tanks containing a mixture of water and ice, having a temperature of about 39° Fahr. The milk is thus brought to a temperature of about 41 to 43° Fahr., and the cream to within 2 or 3 degrees of the milk. Butter, under this system, is made from sweet cream, which has been taken off the milk after it has stood 24 or 36 hours. Before churning, the cream should be warmed to a temperature of 55° Fahr. in summer, and of 57 to 59° in winter. This is done by placing the vessel containing the cream in one nearly filled with water heated to 98° Fahr., until the cream has acquired the proper temperature. Churning is done at the rate of 60 to 70 strokes per minute, and the butter comes in from three-quarters of an hour to an hour. Mr. Swartz finds that 100 kannor ($57\frac{1}{2}$ gallons) of milk will produce 20 Sw. lbs. ($18\frac{1}{2}$ Eng. lbs.) of butter, 32 Sw. lbs. ($29\frac{3}{4}$ Eng. lbs.) of skim-cheese, 16 kannor ($9\frac{1}{4}$ gallons) of butter-milk, and 60 kannor ($34\frac{1}{2}$ gallons) of whey. The price at which Mr. Swartz sold his butter in 1874 is equal to about 130*s.* per cwt. delivered in Göteborg, the delivery costing about 6*s.* per cwt.

On some farms there is a mixed system of butter-making, combined with either the sale of milk or the manufacture of "half-milk" cheese. In such cases the milk may be skimmed after having stood only 12 hours, when of course a smaller return of butter per gallon of milk is obtained, the remaining cream contributing, however, to the richness of the cheese. The chief reason for these and other variations appears to be that, owing to the very general practice of making butter first, and then cheese from the skim-milk, skim-cheese has become more or less of a drug in the market, and other ways of utilising the skim-milk are therefore sought after.*

Although Mr. Swartz's ice-water method has been almost universally adopted on the large and better-managed farms of Sweden, there are some who use it without realising that its object is to hasten the rising of the cream, and thus to ensure sweet-cream butter being obtainable at all seasons of the year. Thus I have seen a milk-house which has been altered to enable

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* On this point see the second of Mr. Dannfelt's papers already referred to.

the ice-water method to be pursued, and yet the cream is still kept to get sour, and the butter made on the old system.

A capital butter-making machine, originally of American origin, but much improved by, I believe, Messrs. Caroc and Leth, of Aarhuus, Denmark, is also coming into use in Sweden. I therefore give the annexed plan and section (Figs. 9 and 10), which were drawn from a machine which we saw at work, by my friend and fellow-traveller in Denmark, Mr. F. Wilton, of the East London Railway. Descriptions of the variations of this machine will come more properly into the Report on Denmark; but I give the annexed sketches at once for the benefit of our own butter-makers on a large scale.

The butter is placed on the circular table (see Fig. 10), the central portion of which is raised as indicated by the dotted lines in Fig. 9. By turning the handle, the bevelled cog-roller is made to revolve at the same time as the table. The person in charge keeps the cog-roller supplied, as it were, with butter, and the pressure exerted during its passage between the table and the roller squeezes out the buttermilk and consolidates its texture. The buttermilk flows down the slanting table to the gutter (*c*), and through the pipe (*d*) to the reservoir (*e*), from which it can be transferred to any other receptacle. The butter is prevented from adhering to the inner and outer sides of the table, as well as from getting to the axis of the cog-roller by the scrapers (*a a*); while the upper scraper (*b*, Fig. 10) takes off any butter that may adhere to the roller. An experienced attendant knows, both by the colour of the expressed buttermilk and by the texture of the butter, when to stop the operation of "making" or "working," for which this machine is so admirably adapted.

Cheese-making.—So much has been written about cheese-making, that it might be reasonably anticipated that nothing very novel could come out of Sweden. The reverse, however, is the fact; for Mr. Swartz has invented a mechanical arrangement for the manipulation of the curd, and a system of cheese-making, which, so far as I know, is entirely new to England. As this system is used to a considerable extent both in Norway and Sweden, a sketch of its leading features may claim a place in this Report.

An ordinary metal cheese-tub, with false bottom and sides for receiving hot water to heat the milk and cook the curd, is furnished with a partial cover to the width of one-half the radius of the tub, leaving a circular open space in the centre. A spindle is fixed vertically in the axis of the tub, and carries on it about 4 or 5 curd-breakers, having a width nearly equal to the internal radius of the tub, and the knives disposed in various

Figs. 9 and 10.—*Elevation and Plan of Butter-making Machine used in Scandinavia.*

Fig. 9.—Elevation.

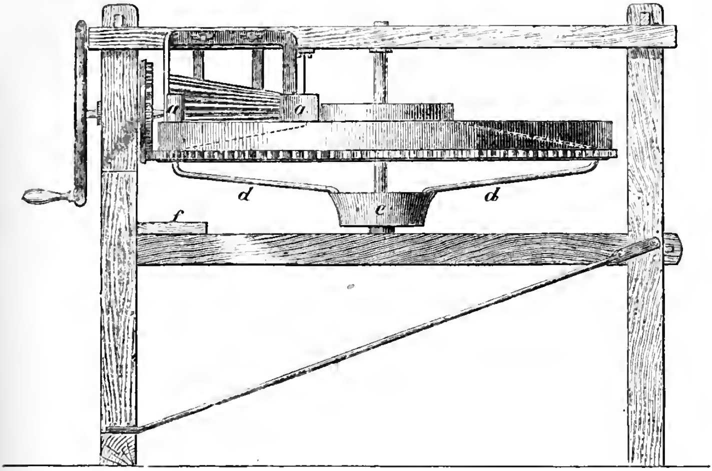
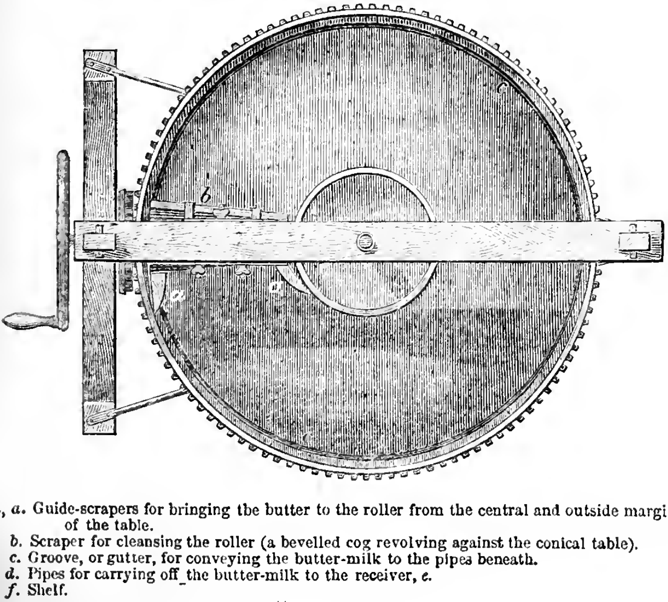


Fig. 10.—Plan.



a, a. Guide-scrapers for bringing the butter to the roller from the central and outside margins of the table.
b. Scraper for cleansing the roller (a bevelled cog revolving against the conical table).
c. Groove, or gutter, for conveying the butter-milk to the pipes beneath.
d, d. Pipes for carrying off the butter-milk to the receiver, *e.*
f. Shelf.

directions, thus:—vertical, horizontal, from the centre outwards and downwards, and *vice versâ*.

The milk is heated to 77°, when the rennet is added, also white-wine vinegar in the proportion of 1 pint per 100 gallons. The milk then stands for about an hour, after which the dairy-maid begins to work the curd-breaker very gently, increasing the speed gradually for half-an-hour, after which time the spindle is attached by a movable rod to a horse-gear. The curd-breaker is then worked by horse-power for an hour and a half; during the first half-hour the curds and whey are kept at the same temperature as before; during the second they are gradually raised to 90°, at which temperature they are kept for the third half-hour. The whey is then run off, and the curd put to stand for 24 hours on a frame with a perforated bottom, which allows the remaining whey to drain off. During this time the curd is turned, but not pressed.

The curd is next put back into the cheese-tub for 24 hours; but this time the spaces between the double sides and bottom are filled with ice and water, so as to reduce the temperature of the curd as low as possible. The curd is then ground twice, salted with 2 per cent. of its weight of salt, packed in frames at a temperature of 55° Fahr., and pressed for four days, viz., one day in the press-cloth, and afterwards three days in sewn cloth, in which it remains for two months, being kept at a temperature of about 62° to 64° the first month, and afterwards cooler.

Both whole-milk cheese and skim-cheese have been made on this system on a large scale, and Mr. Swartz expresses himself well satisfied with its success. The great merit which he claims for it is that it imparts to the cheese a richer flavour than under the old system could be obtained with the same percentage of butter in the milk. Of late, however, the state of the butter-market has rendered butter-making more profitable than the manufacture of whole-milk cheese; therefore I saw, with few exceptions, only skim-cheese made on this system. These skim-cheeses, in Mr. Swartz's and other dairies, exhibited a remarkable tendency to "heave," not in the ordinary manner nor from the ordinary cause (the retention of whey in the curd), but apparently because the low temperature to which the curd had been subjected before being put into the press had contracted the atmospheric air contained in its pores. Subsequently, when the cheese was placed in a temperature of over 60° this air expanded, and as a consequence both its faces, as well as its sides, exhibited a greater or less convexity. Notwithstanding this defect in appearance, and the overstocked condition of the skim-cheese market, Mr. Swartz was getting, last September, 4½*d*. per English lb. for his skim-cheeses when three months old.

"Well-to-do" people in Sweden eat a very thin slice of cheese on bread-and-butter *before* dinner, or something else as an equivalent. Cheese is their Alpha and our Omega; and the little they eat they like highly flavoured. The flavour is obtained by gradually raising the temperature of the "mess," in the course of the two hours occupied by the separation of the curd, from 84° to as much as 102° Fahr., the cheese being otherwise made on Mr. Swartz's method. If a cheese heaves very much it is sometimes cut into small pieces, soaked in warm milk, and re-made; the flavour of such cheeses will eventually be very high, and proportionately appreciated by the devotees of the *Smörågsbord.*

"Cheddar" cheese for ordinary use or for export is made from whole-milk, and sold at about 72*s.* per 120 lbs., if of good quality and flavour. Also butter may be made from the cream of the evening milk, and cheese made from the morning's milking, added to the skim-milk of the evening. If very well made, such "half-skim" cheese has brought as much as 64*s.* per 120 lbs. Both skim and half-skim cheese are not unfrequently made without the addition of salt to the curd, the cheese being in that case soaked in brine for a certain number of days, as is the practice in Holland. A sprinkling of carraway-seeds in the curd is also considered an improvement to cheese intended for home consumption.

Yet another kind of cheese is called "Priest's Cheese," which appears to have had its origin in the ancient custom of paying tithes in kind. A large quantity of tithe-milk was thus brought together periodically, and it was absolutely necessary to turn it quickly into a useful commodity that would keep, and so "Priest's Cheese" was made on the spot. I was informed that the curds and whey are heated to 90° Fahr., and kept at that temperature for a quarter of an hour. The curd is cut, collected, and drained, and then pressed together with the hand only.

Whey-cheese has already been referred to in the first of Mr. Dannfelt's papers, and described in detail in the succeeding note by Dr. Voelcker, in vol. vi. (2nd Series), p. 333.

A Meat-making Farm.

Having given a sketch of the general farm-practice in Sweden and Norway, I shall now illustrate the subject by describing two first-rate farms in some detail. The first of these is Mr. Axel Dickson's farm at Kyleberg, near Wadstena, which is managed on a system entirely different from that which has hitherto been described, and with the production of meat as the chief object of the stock-farming. The second is Mr. Axel Odelberg's

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farm at Enskede, near Stockholm, which I believe to exhibit the national system of farming, namely, for the production of milk, under its most profitable aspect.

Kyleberg is situated in one of the best agricultural districts of Sweden, not far from the shores of Lake Wettern, and from 7 to 10 English miles from the railway-stations of Skennige and Mjölby, on the one side, and from the steamboat-stations of Wadstena and Ödeshög on the other. The district consists of a large undulating plain; the land varies in strength, but is generally of good quality. Large farms and large fields predominate; and although the district, as a whole, appeared to me better cultivated than most parts of Sweden, there were comparatively few roots to be seen, and generally the fields bore evidence that the same system is pursued in this as in other districts, subject to a modification in the case of those farmers who grow sugar-beet for the Wadstena factory.

One of the farms adjoining Kyleberg is a "peasant-farm" of about 160 acres, the rotation of crops being, (1) bare fallow, manured; (2) rye; (3) and (4) seeds; (5) mixture of oats and barley; (6) bare fallow; (7) wheat or barley; (8) tares and oats; (9) mixture of oats and barley. Thus two-ninths of the land are in bare fallow every year, two-ninths in grass, one-ninth in tares, and four-ninths in corn, and manure is applied only to the fallow for rye; and yet not less than 5 horses (generally 6) and 10 oxen are required to work this farm. The staff of labourers is never less than 5, in addition to the occupier himself, who probably works harder than any of them. From 16 to 20 cows are kept, and most of the butter and cheese made is consumed by the farmer and his men. The rent paid is about half a guinea per acre, and the farmer is looked upon as in advance of his order.

This little digression is necessary to show that Kyleberg does not lie in a district exceptionally favoured in its soil or climate. In fact, it is about three or four miles from Hofgården, so often mentioned in the preceding pages.

Kyleberg consists of nearly 900 imp. acres of rather strong land, of which about 136 acres are in permanent old grass; 140 acres which have been reclaimed from the lake are planted with trees, amongst which coarse grass and reeds furnish auxiliary keep; 68½ acres are partly occupied by soldiers,* and partly let to labourers; and 16 acres comprise the park, gardens, &c. The land under the plough is cropped as follows:—(A) 103 acres under a six-course shift, viz., (1) turnips or other roots; (2) barley; (3) and (4) seeds mown and aftermath fed; (5)

* On this point see p. 255.

wheat, the ley having been ploughed out in July; (6) mixture of oats and barley. (B) about 383 acres are under a seven-course shift, of 55-acre fields, viz., (1) bare fallow or turnips; (2) rye after fallow, and barley after turnips; (3) and (4) seeds mown; (5) tares, cut green; (6) wheat; (7) mixture of barley and oats. (C) 68 acres under a four-course shift (1) roots, last year carrots; (2) barley, followed the same year by (3) rye, cut green the next spring, and succeeded by tares and oats, also cut green; (4) barley, or mixed barley and oats. With reference to this shift it should be mentioned, that the taking of fodder-rye after barley, to be succeeded the same year by tares, is an experimental effort to get two green crops in one year. If it succeeds as well as it bids fair to do, Mr. Dickson will have once more well earned his present reputation as a pioneer in advanced Swedish farming.

At present Mr. Dickson is going over his six-course shift with two root-crops in succession, with a view of thoroughly cleaning the land and putting it into better heart. Sometimes also he allows the grass to remain longer than two years, if it is good enough. Seven years ago Mr. Dickson bought a set of Howard's round-about steam-tackle. The economy and advantage of using steam, by enabling the fullest use to be made of every favourable day in the short Swedish season for the outdoor work of the farm, appear to have been very generally admitted by those who have seen his tackle at work, Mr. Dickson's ordinary farm-labourers having soon acquired the necessary facility in its use. His example has not hitherto been followed; but I shall be surprised if the next year or two does not witness the introduction of one, if not two, other sets of steam-tackle into Sweden.

Bare fallow, followed by Rye.—The stubble is generally steam-cultivated as soon as possible after harvest. In spring the land is ploughed or cross-cultivated by steam, and then harrowed, the sladd following the harrow. Farmyard-manure is carted out in June and ploughed in immediately. Rye is sown the middle of August, and the preparation of the seed-bed is as follows: the land should be left at least three weeks after the dung is ploughed in, when it is harrowed previous to sowing; if, however, it has become hard, in consequence of wet weather, or if weeds render it necessary, it is gone lightly over with the steam-cultivator or the ård. From 10 to 11 pecks of rye are drilled per acre, and a good crop is from 5 to 6 quarters.

Seeds.—The mixture used is about 10 to 12 lbs. of red clover, 1½ lb. or more of alsike, 7 or 8 lbs. of Timothy, and enough rye-grass to make rather over 28 lbs. per imperial acre. All the seeds are sown with a broadcast machine, as soon as possible in the spring when on rye, or on the barley immediately after it is sown. Mowing takes place between Midsummer and the beginning of July, according to the season, Mr. Dickson preferring to cut before the ryegrass flowers, as the quality of the hay is then much better; and although the quantity is necessarily short, a good aftermath is obtained, and may be either cut or fed. Originally he had his ryegrass-seed from England;

now he reserves a patch for seed every year, and in this way he has not only acclimatized the seed, but also, with careful winnowing, much improved its quality. The same method is pursued in the selection of grain for seed.

Tares.—The seeds are broken up in the autumn by steam or cattle; the land is harrowed in spring and sown in the middle of April with rather more than 4 bushels of seed, two-thirds being tares and one-third oats per acre, 150 lbs. of Mejillones or Baker's guano, with 19 per cent. soluble phosphate guaranteed, having been first applied. The tares are cut green as wanted, beginning not later than the middle of July, about the time that they commence podding.

Wheat.—The tare-stubble is broken up by the steam-plough or cultivator at the end of July, sometimes the beginning of August, and the land is then harrowed, sladded, and drilled with 10 to 11 pecks of wheat per acre at the end of August, or as soon as possible, early sowing being preferred. The harvest is generally in August; the crop is cut by a reaping-machine, if possible, and all harvest operations are performed by the regular staff of farm labourers. The crop is generally the same as rye, or a little more; and the manure used for it is also 150 lbs. per acre of Mejillones, or Baker's guano, put in with the drill immediately after the seed.

Blandseed (mixture of Oats and Barley).—The climate of Kyleberg is too dry for the growth of oats as a separate crop, therefore they are grown intermixed with barley, and a certain quantity separated afterwards, if required. Blandseed follows wheat, the stubble being broken up in the same way as for that crop. From 14 to 16 or 17 pecks of seed is sown either by hand or with a broadcast machine about the middle or end of April, and followed as usual by 150 lbs. of Mejillones, or Baker's guano. Mr. Dickson is doubtful of the advantage of drilling spring-corn, as he thinks that the ground is not so well covered in that way as when sown broadcast—an important consideration in his dry climate. The cultivation of barley does not differ essentially from that of blandseed, and it may be mentioned that this year one piece yielded over 6 quarters per imperial acre.

Potatoes.—This crop follows blandseed in the 4 or 6 course shifts, about 18 acres being grown in one or the other. If possible, the manure is carted in the autumn on the stubble, which is then ploughed, sometimes by steam to the depth of 8 or 10 inches, but otherwise by horses or oxen, 8 inches deep. If the stubble is not manured in the autumn, the steam-cultivator is used instead of the plough; and the manure is put on the land in spring, and got in with the plough or cultivator. Generally it requires only harrowing again; but sometimes the use of either the cultivator or the ård is necessary to get a good tilth. Just before planting, the usual dressing of 150 lbs. of Mejillones, or Baker's guano, is sown. The potatoes are planted in the middle of May, the setts being placed in the furrows made by a plough which precedes the planter, and covered by one which follows him. A short time after planting, the land is levelled with the "sladd" and then left until the potatoes appear, when it is harrowed. During early growth a double-row horse-hoe is used, as required, to keep the land clean, hand-hoeing being also resorted to. When the plants are ready they are earthed up once or twice with a double-mouldboard plough, and kept clean, as necessary. Harvesting is done with Howard's potato-plough. The ordinary crop is from 220 to 260 bushels per acre, though as much as 375 bushels has been obtained in an exceptional season.

Turnips.—The cultivation of the land is the same as for potatoes. About 5 lbs. of seed is drilled per acre, commencing with Swedish turnips, if possible, in the middle of April, and continuing them until the middle or end of May. White and yellow turnips are sown until the beginning or even the middle of June. This year about 35 acres were sown, all Swedes. White and

yellow turnips are only sown when Swedes cannot be got in early enough, or when re-sowing is necessary.

Carrots.—The land is prepared as for turnips; but, if possible, the manure should be got in during the autumn. About 4 or 5 lbs. of white Belgian carrot, per acre, is dropped in by women, who use small hoes, the handles of which exactly measure the distance between the plants. The after-cultivation is the same as for other roots. Carrots are best after potatoes or Swedes, as they do better without stable-dung. They are harvested by pulling, and using digging-forks, when necessary, by the ordinary staff of farm labourers.

Lucerne.—About an acre and a half has been sown as an experiment, instead of clover-seed, 20 lbs. of seed per acre being used. 1874 was the second year, and, notwithstanding the dry season, a small mowing was obtained. The first year the yield was very little. This plant grows almost wild in some parts of Sweden, having probably been imported with other farm-seeds. This fact encourages the idea that it may be successfully cultivated.

Cattle.—About 40 Shorthorn cows are kept, and all the calves are reared. Last September, the young stock consisted of 10 in-calf heifers, 15 yearlings, 15 two-year-olds, 20 calves, and 5 young bulls. Calves drop all the year round, but generally come from the middle of January to the middle of May. They are sold at all ages, from 1 week to 6 or 8 months old, and customers come from all parts of Sweden. The price of a bull-calf a week old is 4 guineas; at a month old, one would fetch 7*l.*; and at 6 months, 18*l.*

The cows are kept on grass day and night, from about the 10th of June until the beginning of October, and if the pastures are not very good, they get some tares on it; but this year the mild autumn enabled them to be kept on the pastures by day until the middle of November. This was a great help, as the shortness of the hay and root crops rendered the keep of so many cattle of all kinds (over 200 head, including cows, young stock, feeding cattle of all ages, and working oxen) as are to be found on Kyleberg, during a long winter, a matter of considerable anxiety. In view of these circumstances, the following dietary has been arranged for the winter of 1874-75:—Cows will have 4 lbs. good hay, 5 lbs. blandseed meal, and 27 lbs. roots (carrots, swedes, and steamed potatoes) per diem; also straw as much as they will eat, partly cut for mixing, and partly uncut and mixed with the hay.

The roots, meal, chopped straw, and chaff, are all mixed and pressed down in boxes, holding enough for one day, and the mixture is allowed to become slightly heated. The chaff and chopped straw are first put down in a layer of about 4 inches, then sprinkled over with water. A portion of the pulped roots, or steamed and crushed potatoes, is then spread over the straw, &c., and then more straw sprinkled over. All are then mixed and pressed down, and the same process is repeated until the box or bin is as full as is required for the number of cows.

The cows are fed at 5 A.M. with mixture as above; at 7 A.M. they have water and a little straw afterwards; and at 11.30 A.M. the same as at 5. At 1 P.M. they are watered, and then get a little hay or straw; at 4.30 P.M. mixture as at 5 A.M., and finally at 8 P.M., blandseed straw. Just after calving, the cows get a little more meal (2 or 3 lbs.), given generally in water, and sometimes sprinkled over other food, also a little more hay under ordinary circumstances. Their average production of milk exceeds 500 gallons per annum.

The same principle of feeding is carried out for the working-oxen and the feeding-stock, only that the former get a little less meal and hay, and the latter 10 or 12 lbs. of meal and cake, and more roots. The root-crop of 1874 having been very light, the feeding-beasts have this winter received no whole swedes; nevertheless they have done very well, but probably not improved so rapidly as usual.

From 30 to 35 feeding-beasts, crossed Shorthorn and the Swedish Herrgårdsrace, are bought at about 6 months old, and sold fat at about 3 years old. They come in as calves in October, and are treated the same as those of Mr. Dickson's own breeding. When roots are plentiful, they are fed on turnips and straw; but if not, as this year, they get mixture like that made for the cows, and about ½ lb. of oilcake per head. In summer, the feeding stock go on as good grass as possible, and if it is not good enough, they get ½ lb. of oilcake each. In October they go into the houses, as a rule, and are fed as before, but with larger quantities. In the spring they again go on the grass, and the third winter they are given as many turnips as they can eat, though if the turnips run short, they get oilcake and oatmeal, some requiring more of this assistance than others. They are finished off in April with an increase of meal and some oilcake. When sold, the beasts weigh from 1500 to over 1800 English lbs. live weight, and fetch from 27 rd. to 30 rd. per centner, equal to about 4*d.* to 4½*d.* per English lb. About 30 fat beasts are sold yearly in Gothenburg, and most of them go to England. Like most English feeders, Mr. Dickson finds that the cattle leave little or no profit except in the manure; but he is quite satisfied with the results which he thereby obtains in his crops. It may be mentioned, as an indication of the quality of the swedes, that cattle can be fattened entirely on them and straw, though it is not done.

Sheep and Pigs.—Very little need be said under this head, for although 30 Cheviot ewes and 5 breeding-sows are kept, and their produce reared, it is only because the requrements of the estate render the home production of mutton, pork, and bacon, a matter of convenience, and there is nothing in the management of the animals that calls for detailed description.

Horses.—Bearing in mind what has already been stated (p. 198) as to the horse-power required to work a farm in Sweden, it will be interesting to ascertain the reduction of such force caused by the use of steam-tackle. Twelve horses and 16 working-oxen are used for working Kyleberg, and as the total amount of land under rotation is 554 acres, this gives an average of 5 draught-animals to every 100 acres under the plough. On an ordinary Swedish farm, 80 acres of this would be in bare fallow, and 240 acres in seeds; but on Kyleberg, only 27 acres are in bare fallow, and 144 acres in seeds. The staff of draught-animals is therefore not more than two-thirds of the strength usual on large farms in Sweden, if we reckon only the land that needs horse-labour in each year.

In summer the horses are fed chiefly on green tares and clover, with very little corn. In winter they get from 10 to 12 lbs. of oats (whole and crushed), and from 10 to 12 lbs. of hay per diem. The working-oxen get, in summer, tares and oat-straw, or some other green food, such as cut grass. In winter they get a few turnips, and about 10 lbs. of hay, otherwise 2 lbs. of oat-meal, 1 gallon of turnips, and as much straw as they can eat.

Labourers.—When Mr. Dickson bought Kyleberg, the land had been cropped on the two-field system, half fallow and half corn, and the land was manured about once in 30 years. The labourers lived in hovels, and were paid in kind, giving so many days' work for a stipulated quantity of each description of produce. It is unnecessary, however, to describe the difficulties which attended and obstructed the alterations made by Mr. Dickson, either in the course of cropping or in the treatment of the labourers.

The labourers are now hired in July, for the twelve months commencing the following October, a system which is not unusual in those parts of Sweden where hired labour, properly so termed, is the general rule. Commonly the agreement stipulates for the payment of so much hiring-money, and so much wages; but Mr. Dickson puts both sums together. His married labourers—16 in number—each get about 6*l.* 2*s.* 6*d.* per annum in money, about 27 bushels of rye, 13½ bushels of barley, 3 cubic fathoms (of 108 cubic feet each) of wood per annum, and ½ kanna (rather more than 1 quart) of milk per day. His cattle-man receives 8*l.* 13*s.* 4*d.* in money, the same allowance of rye, barley, and wood as the labourers, and twice the quantity of milk. The bailiff, the foreman, the smith, the carpenter, and every other grade of labourer, has his special scale of payment, some being very complicated. For instance, the smith (an important man on the farm worked by the only steam-plough in Sweden)

receives 16*l.* 13*s.* 6*d.* in money, 18 bushels of rye, 13½ bushels of barley, rather more than 2 bushels of peas, 9 bushels of mixed barley and oats, 3½ bushels of malt, 22½ bushels of potatoes, 2 bushels of kohl rabi, 30 head of cabbage, ¼ cwt. pork, 93 lbs. of beef, 93 lbs. of herrings, 7 gallons of salt, about 3 lbs. of lard, and the same quantity of hops, and 4 fathoms of wood per annum, as well as 1 kanna (nearly three-fifths of a gallon) of milk per day.

In addition to their wages and allowances, each labourer has part of a house and a piece of garden rent-free. The details of the construction of the houses for the ordinary farm-labourers, which are built to hold four families each, and those of the ample store-cellars and out-houses, will be understood by reference to the annexed plans, sections, and elevations (pp. 235–237), which Mr. Dickson was so kind as to trace for me from the original drawings.

These cottages are built of wood, *cela va sans dire;* but they cost 340*l.* per block, including the out-houses; and Mr. Dickson told me that if he had clay fit for making bricks on his estate he would build no more wooden cottages. He thinks that they are not much, if any, cheaper in first cost than brick cottages, and are continually requiring repairs. If this is the case in Sweden, it would obviously be useless to import such cottages into England.* Like most of the wooden houses in Sweden, the Kyleberg cottages are stained with a kind of red ochre, which is made from a refuse material—an impure red oxide of iron—obtained from the sulphur works. This material is mixed with meal, oil, turpentine, and a solution of sulphate of iron; and its application tends to preserve the wood from decay. The cottages are roofed with the thin spruce-splints termed 'shingle.' Before use, these 'chips,' in appearance, are soaked in a solution of sulphate of iron; and their durability as a roofing material was attested by the present excellent condition of the roof of Mr. Dickson's granary, which was built twenty-two years ago; since then the roof has not been once renewed, and it is perfectly sound now.

Fences.—The ordinary Swedish fence, hideous to the eye, and with many practical drawbacks, is at Kyleberg being replaced by quick fences, which are planted on the flat, the plants being 6 inches apart in a single row. The year after planting they are cut a little to strengthen the bottom, and afterwards are trimmed as required.

* *Vide* 'Journal of the Bath and West of England Society,' 3rd Series, vol. v. p. 196.

If these fences fulfil the promise of their youth, they will, in a few years, add another illusive feature to Kyleberg; and with the steam-plough, the Shorthorns, the Cheviot sheep, the turnips, the stacks of corn, the reaping-machines, the fixed engine and its tall chimney, will tend to make the agricultural traveller imagine that he has suddenly stepped from Sweden into the neighbourhood of Edinburgh.

Figs. 11–14.—*Illustrations of a Kyleberg Cottage, with Accommodation for four Families.*

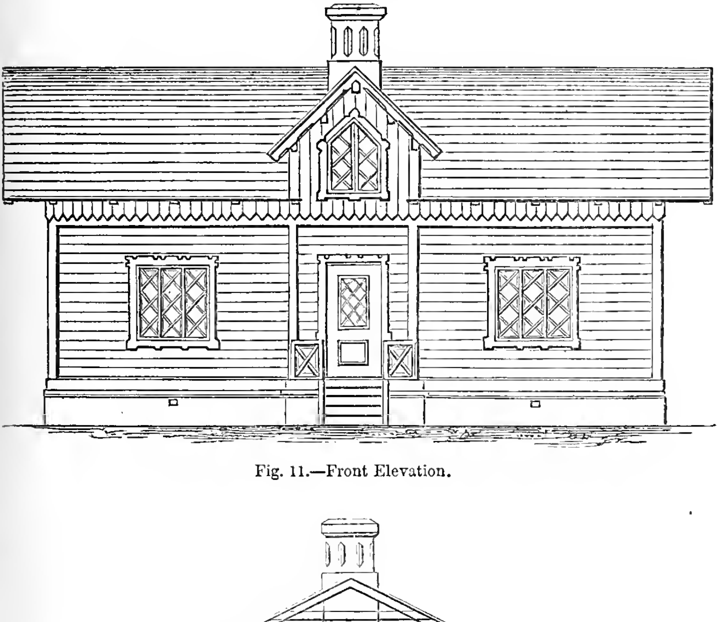


Fig. 11.—Front Elevation.

Fig. 12.—Section along the line $a\ b$ in Figs. 13 and 14.

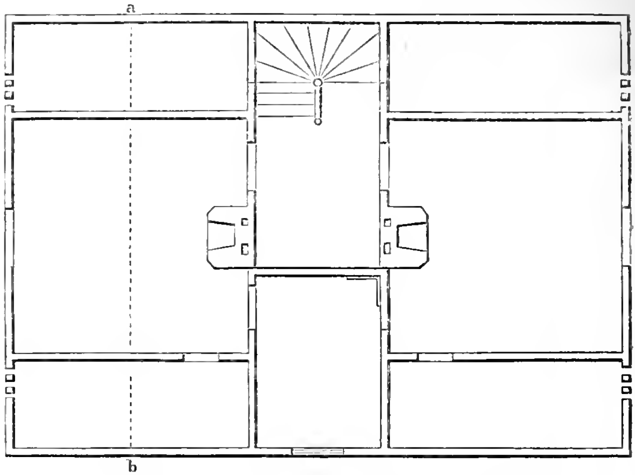


Fig. 13.—Upper Floor, with accommodation for two families.

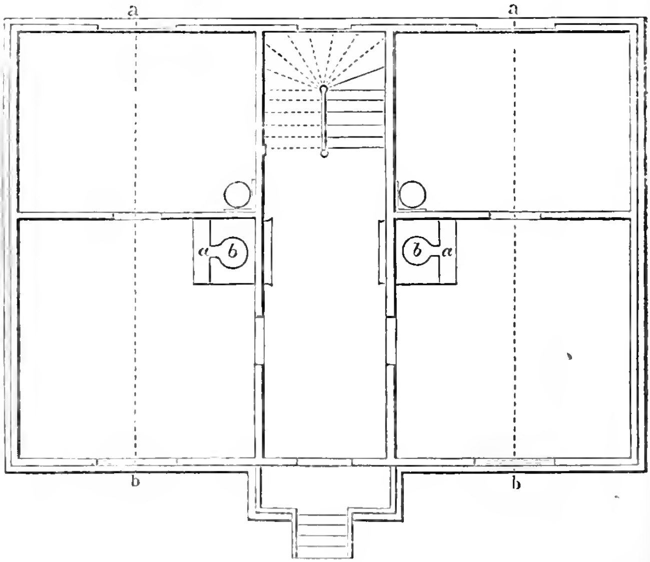


Fig. 14.—Ground floor, with accommodation for two families: *a*, fire-place, in front of *b*, the oven. The family living above has the right to bake with the family living beneath them. Each family on the ground-floor has two rooms, and one family on the floor above has three and the other four rooms.

Figs. 15-17.—*Illustrations of the Out-buildings to a Kyleberg Cottage (to accommodate four Families).*

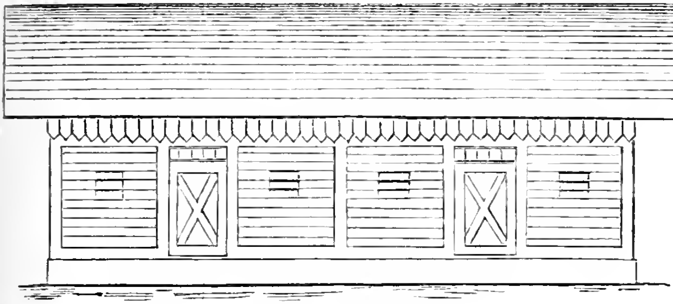


Fig. 15.—Elevation.

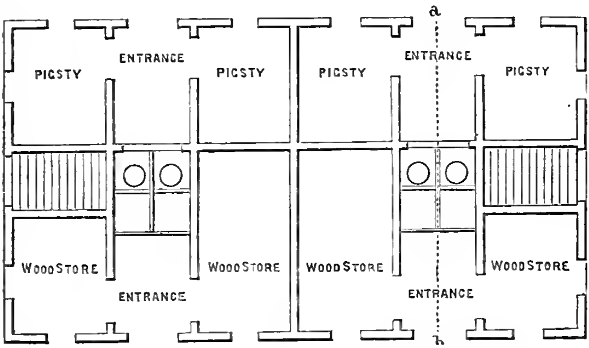


Fig. 16.—Ground Floor, showing steps, on right and left, leading to cellars beneath.

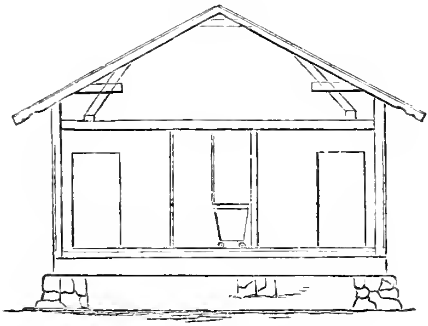
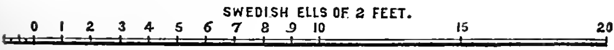


Fig. 17.—Section along the line *a b*, in Fig. 16.



A Milk-producing Farm.

Enskede is almost in the suburbs of Stockholm, and is worked as a suburban dairy-farm with remarkable ingenuity in conjunction with a distillery, by their owner, Mr. Axel Odelberg. Here, therefore, exist the most favourable conditions for obtaining a profitable result from the management of a dairy-farm in Sweden; and from this point of view the following sketch of the farming and its results may have a special interest. The facts given are taken partly from my note-book, partly from Mr. Odelberg's published pamphlets, and partly from the account of his farm which appeared in the catalogue of Swedish Exhibits at Vienna, 1873.

The farm is prettily situated in a valley, bounded and broken here and there by wooded hills of no great elevation. In the lower part of the valley the land is strong loam, containing a fair quantity of vegetable matter; but nevertheless difficult to work both in very dry and very wet weather. The soil of the upper part of the valley contains more sand, and is therefore lighter, though also rich in vegetable matter. There are three agricultural divisions of the farm, viz., the stronger land, the lighter land, and the irrigated meadows.

The stronger land comprises about 227 acres, and is farmed on a 10-course shift; namely, first year, bare fallow, well dunged, and followed by rye in the second year, either allowed to ripen, or eaten as green fodder, according to circumstances, and sown out with seeds (Timothy grass, red clover, and alsike), which remain down for three years. In the sixth year oats are taken, and in the seventh, vetches for fodder, well manured; then wheat in the eighth, barley in the ninth, and oats, peas, vetches, or other pulse-crops, in the tenth year.

The lighter portion of the arable land measures about 148 acres, and is divided into twelve fields, eleven of which have the following rotation, while the twelfth is cropped as circumstances may render necessary:—(1) bare fallow, dunged, and now and then sown about St. John's Day with vetches to be used as green fodder; (2) rye or barley, sown out with the mixture of clover and grass already mentioned; (3), (4), and (5), seeds mown; (6) rye, after a deep ploughing and manuring; (7) potatoes, also manured; (8) barley; (9) vetches, dunged; (10) barley, and (11) oats.

The third division of the farm, consisting of 33 acres, is now almost exclusively irrigated meadow-land, which is watered in spring and autumn with accumulations of rain and drainage-water from the homestead and the surrounding land, including the runnings from the stables, cowhouses, &c. It may also here be mentioned that four horses are kept in employment carting town-manure from Stockholm to the farm; therefore there is

comparatively little need of artificials, although now and then the use of superphosphate and sulphate of ammonia may be deemed necessary. Mr. Odelberg also lets a cow-house, without land, to a man who keeps from 40 to 50 cows, and supplies him with as much straw as he requires at half the Government tax-price, on condition that the manure becomes the property of Mr. Odelberg without payment. The cow-keeper is at liberty to feed his cows as he pleases.

Recently, about 120 acres have been added to the home-farm, and since then the stock of cows has reached its maximum. It should be remembered that the farm has varied in size from time to time, otherwise the great variations in the quantity of milk produced, as stated in the accounts of different periods, to be quoted presently, will not be properly understood.

The details of the cultivation of the land need not be given here; but those relating to the treatment of the milch-cows will be read with interest.

From 100 to 120 cows have latterly been kept during the winter months, and from 80 to 90 during the summer. They are bought in Stockholm within a week of two of calving, and are generally of the native Swedish race, crossed more or less with Dutch, or one of the English breeds. Every year about 60 or 70 cows are bought, and about the same number sold, for as soon as a cow gives less than 2 kannor (about $1\frac{1}{6}$ gallon) of milk per day, it is sold off. The cows are bought as good as they can be obtained, and the prices given vary from 8 guineas to nearly 14. They are sold in good condition, and in 1873 fetched from 4 to $4\frac{1}{2}$ rd. per liss pund (=about 3*d.* per English lb.) live weight; but in 1874 they did not fetch more than $3\frac{1}{4}$ to $3\frac{1}{2}$ rd. per liss pund (or not more than $2\frac{1}{4}$*d.* to $2\frac{1}{2}$*d.* per English lb.) live weight.

Between 20 and 30 cows—the pick of the various purchases—are kept for several years, being allowed to run dry previous to calving, and otherwise treated as on breeding-farms. The average production of milk per cow, taking into consideration only the number on the farm at any one time, is 1000 kannor (576 gallons) of milk per cow per annum, which is equal to over 18*l.* per cow, at $7\frac{3}{4}$*d.* per gallon, the price the milk has recently fetched on the farm. This does not mean, however, that the cows, taken one with another, give this quantity, because as soon as a cow gives less than 2 kannor per day it is sold, and replaced by one that will calve in a week or two, and then give from 5 to 8 kannor ($2\frac{9}{10}$ to $4\frac{3}{5}$ gallons) per day, though occasionally not more than 4 kannor ($2\frac{3}{10}$ gallons). In this way a high average production is kept up; and with this system, the close vicinity of Stockholm, and the advantages of an adjoining

distillery, Enskede ought to furnish an example of a highly profitable dairy-farm, if such an establishment exists in Sweden.

The distillery begins work about October 1st, and from this date the number of cows is increased to the maximum as soon as possible. As a system, they are kept in the houses all the year round; but if necessary, on account of scarcity of fodder that can be cut, they are turned out to graze the aftermath about the beginning of September. The food given in the houses consists of three meals per diem, namely, at 4 A.M., at 3 P.M., and at 7 to 8 P.M. From the commencement of distillery work the food consists of a mixture of thick draff and straw, which is left during the night to ferment. In the morning, at 4 o'clock, the draff is first given; and when the cows have drunk as much of it as they care for, they have as much of the fermented straw and draff as they like to take, then a little oatmeal, being a proportionate part of from $1\frac{1}{2}$ to $2\frac{1}{2}$ cwt. allowed for all the cows during the day. By 10 to 11 o'clock the byres are cleaned, and the cows allowed to remain quiet until 3 o'clock. From 3 to 6 they are again fed as in the morning. The distillery work ends on May 1st; but there is a reserve of draff which usually lasts another fortnight, after which the summer-feeding of the cows commences. For the first month—from May 15th to June 15th—their food consists of hay, oats, and straw, mixed together and fermented, just as the straw and draff had been in the winter. From June 15th to the end of the summer the cows are fed on cut grass from the water-meadows, and green vetches; and during the last two or three weeks in September they are put on the aftermath by day, getting in the evening cut grass and green clover in the houses. All the cows are milked between 4 and 6 A.M., the best 20 to 30 a second time between 11 and 12, and the whole again between 4 and 5.30 P.M. The milk is sent to Stockholm at six o'clock in the morning and half-past five in the evening. It is sold on the farm at (in 1874) nearly $7\frac{3}{4}d.$ per gallon to a man who is at the expense and trouble of distribution, but who has the use of two horses and a cart without payment, as well as three rooms and firing at the farm.

There are 16 horses and 20 working-oxen employed in the cultivation of this farm (excluding the two horses used for the carriage of milk, but including the four employed in carting town-dung). Taking the whole of the arable land to measure 500 acres, this number shows rather more than 7 draught-animals to each 100 acres under cultivation, although more than 100 acres are annually in artificial grass; and the greatest possible care has been taken to arrange the farm-machinery, so that it may be connected when required with the steam-engine belonging to the distillery.

The preceding details as to the number of cows and their production of milk refer to the autumn of 1874, while the following are translated from Mr. Odelberg's account of his farm for the year ending May 31st, 1874 :—

"About 100 cows are usually kept. During the winter months the shed is filled with 108, and some dry cows are, besides, housed with the oxen. During the summer, on the other hand, the number is lessened to about 90, and calves are no longer bred, but the number is recruited by buying cows which have just calved. Formerly, when the milk could be sold in Stockholm for a higher price, and the profit from the dairy could in consequence be more satisfactory, without considering too carefully the most profitable way to manage that branch of industry, breeding-cows were kept at Enskede, and several calves were yearly bred from these. At one time cows of Friesland and Tonder races were exclusively kept; but, as before said, this mode of management, however pleasing and agreeable to the eye, had been obliged to be abandoned for one more profitable.

"During the course of the financial year ending with the 31st of May last, the number of cows kept had been on an average 102, and the milk produced 59,582 gallons, whereof 53,242 have been sold, and the rest consumed by the household and the families attached to the farm. The shifting of animals has been :—sold and killed, 2 bulls and 56 cows; for which the dairy accounts have been credited with 662*l.* 2*s.* 3*d.*; besides which, 1 cow died by sickness: 4 bulls and 65 cows have been bought, for which 728*l.* 4*s.* 6*d.* have been paid. The fodder used for feeding the cattle during that time has been—hay, and green fodder reduced to hay, 2449 cwts.; groats and meal, 635 cwts.; salt, 37·8 cubic feet; draff, the refuse product of 7515 cwt. of flour and groats; and 11,200 cubic feet of potatoes, of which oxen and swine received a little more than $\frac{1}{10}$th part."

The following additional details are translated from the 'Catalogue of Swedish Exhibits at the Vienna Exhibition' in 1873 :—

"The live stock consists, besides draught-animals, of about 100 cows—in winter a few more, in summer a few less—3 bulls, about 20 pigs, and some poultry. . . . . Calves are not reared, but the number is kept up entirely by purchase, about one-third of the whole being annually sold out and others bought in to replace them. At the commencement of the last-ended financial year, viz., on June 1st, 1871, the number of cows and bulls was 93, which together weighed nearly 800 cwt., or an average of 952 lbs. each. At the end of the same year there were 97 animals, having a total live weight of over 840 cwt., or an average of 974 lbs. each. In that year an average of 100 animals had received, exclusive of straw and chaff, most of which had been used as litter, the following quantities of food:—Meal, 953 cwts.; hay, and green fodder reduced to hay, 2962 cwts.; draff during six months, 385,920 gallons; linseed-cake, 42 cwts.; and pasturage, corresponding to hay, 125 cwts.

"The value of the draff is estimated at 20 per cent. of that of the raw materials from which it is obtained. These, in so far as they contributed to the usefulness of the draff to the cows, were 3217 bushels of potatoes, 2939 cwts. of rye-meal, and 2288 cwts. of barley-meal.

"The total production of milk was 58,857 gallons, or an average of 588 gallons per cow. All the milk was sold on the spot at 6½*d.* per gallon (28 öre per kanna), which left a profit on all the cows of 194*l.* 14*s.*, or an average of 1*l.* 18*s.* 11*d.*, after deducting the cost of fodder, labour, rent of land and cow-stall, and other items."

In further elucidation of the mode in which the profit on the

cows is calculated, I subjoin the following translation of an account published by Mr. Odelberg in his description of 'Enskede in 1868,' and of the paragraphs explanatory of it:—

"To give an idea, although incomplete, of the two principal branches of farming industry at Enskede, viz., agriculture and dairy-keeping, two Tables are annexed, made out from the last year's accounts; the one showing the cost of cultivating the soil during the last three years, and the revenue therefrom; the second being an exposition of the debit and credit derived from the dairy department during 1865 and 1866, with a calculation of the cost or production of one kanna of milk (= 0·576 imperial gallon) during those years. . . . .

"It can be seen from the first of these Tables* that a harvest is required exceeding in value 4*l.* 12*s.* per acre of the whole area, the barren soil included, to cover the yearly expenses of cultivating the soil, together with the interest of principal and floating capital; that the expenses for labour, seed-corn, manure, &c., alone attain the amount of 3*l.* 14*s.* per acre, that out of the sum which the harvest exceeds in value the last-mentioned amount, the rent—13*s.* per acre—must first be paid, and then the interest on the floating capital, 5*s.* 3*d.* per acre; and that what then remains is the net profit on the tillage, which profit has been on an average 111*l.* 10*s.* these three years.†

TABLE XI.—CALCULATION of the COST of PRODUCTION of MILK at ENSKEDE during the FINANCIAL YEARS 1865–66 and 1866–67.

The year 1865–66. *Production of Milk*, 68,564 kannor = 39,544 gallons.

		Expenses. Gross.	Expenses. Net.	Expenses. Per Gall. of Milk.
		£ s. d.	£ s. d.	d.
Fodder: viz. grass, hay, and pasturing ..		320 14 0		
Straw		119 2 9		
Meal, groats, rape-cake, and salt		472 8 9		
Draff		100 13 3		
Total cost of food		1012 18 9		
Less the value of the manure, equal to the value of the straw		119 2 9		
			893 16 0	5·4
Other expenses:—				
Labour, wages, transport (the carriage of milk not included)		170 14 6		
Purchase of cows..		269 1 3		
Interest on capital, proportionate share of expenses of management, &c.		78 1 0		
Lighting and sundries		12 10 5		
Total for other expenses ..		530 7 2		
Less cattle sold, dead meat, hides, &c.	271 15 0			
Increased value of stock	46 15 5	318 10 5		
			211 16 9	1·3
Total cost of milk		.. ..	1105 12 9	6·7

* The re-publication of this Table is not necessary.

† Equal to about 5*s.* 6*d.* per acre.

TABLE XI.—CALCULATION of the COST of PRODUCTION of MILK—*continued.*

The year 1866–67. *Production of Milk*, 62,018 kannor = 36,322 gallons.

	Expenses. Gross.			Net.			Per Gall. of Milk.
	£	s.	d.	£	s.	d.	d.
Fodder: viz. green fodder and hay	395	15	5				
Straw	105	12	7				
Meal, groats, rape-cake and salt	465	12	9				
Potatoes	6	7	9				
Draff	101	17	9				
Total cost of food	1075	6	3				
Less the value of the manure, equal to the value of the straw	105	12	6				
				969	13	9	6·4
Other expenses:—							
Labour, wages, transport (the carriage of milk not included)	175	0	7				
Purchase of cows	139	13	9				
Interest on capital, proportionate share of expenses of management, &c...	80	17	3				
Sundries	19	8	8				
Decreased value of stock during the year ..	51	14	9				
Total for other expenses.. ..	466	15	0				
Less for cattle sold, dead meat, hides, &c. ..	232	2	0				
				234	13	0	1·6*
Total cost of milk	..	..		1204	6	9	8·0

"From the second Table (XI.) it is seen that during the year 1865–66 the production of milk was 39,544 gallons, the cost of production having been nearly 29 öre per kanna (= 6¾*d.* per gallon); that, on the other hand, the following year, 1866–67, the production of milk was only 36,322 gallons, which had cost nearly 35 öre per kanna (=8*d.* per gallon). This unsatisfactory result of the dairy during that year must be ascribed to the bad quality of the fodder produced in 1866, and its bad nourishing properties. The first year the dairy gave a profit—the latter one, on the contrary, a loss. The price of milk in Stockholm is not high enough to cover so heavy a cost of production as 35 öre, as well as the dairy and selling expenses. It must be remembered that during both these years the time for the distillation of bränvin was limited to three months yearly, and that of the draff produced a part was sold to the families attached to the farm and to neighbours. As the means of obtaining that powerful fodder is limited to a short time, it cannot be used as a chief ingredient, therefore it has no very important place among articles of fodder."

MEAT *versus* MILK.

We are now in a position to estimate the relative advantages and disadvantages of meat-making and milk-production in

* Nearly.

Sweden, taking into account the various circumstances which have been described in the preceding pages.

When milk is sold in a town the price varies from less than 6*d.* per gallon to more than 9*d.* (at Gefle), subject to certain expenses of delivery, or to cost of horses, house-room, firing, &c., supplied to the distributor. When it is made into whole-milk cheese, it may yield a maximum gross return of over 7*d.* per gallon; but on the one side must be deducted the cost of labour, and on the other must be added the value of the whey; and, according to Mr. Swartz, the net return is not more than 6*d.* per gallon. When made into butter and skim-cheese the return may be as much as $7\frac{1}{2}$*d.* per gallon at the highest prices for butter and skim-cheese, subject to deductions as in the case of whole-milk cheese, and probably the net result would not be very different.

It is, however, only in exceptional instances that the highest prices are obtained; and those instances are where highly intelligent and educated men have both the capital to invest in their business and the business capacity and energy necessary for its effective supervision. If ordinary cases were taken, a large deduction from the preceding figures would be necessary to represent the truth; but, for the sake of simplicity, it will answer my purpose to assume that 6*d.* per gallon represents the average net return which an ordinary Swedish farmer receives for his milk.

The next question is, What does this milk cost to produce? and it is almost unnecessary to say that very few farmers can answer the question. We have seen, however, that in the year 1865–66, Mr. Odelberg's milk cost him $6\frac{3}{4}$*d.* per gallon, and 8*d.* per gallon in the year 1866–67, after deducting the value of the manure. Mr. Odelberg remarks that the small quantity of draff available in those years both increased the cost of production of the milk and diminished its quantity; therefore one would say, *à fortiori*, that on ordinary farms on which draff cannot be obtained, the cost of production must be greater than at Enskede. Then Mr. Odelberg takes care, by the judicious sale and purchase of cows, to keep up the average production of milk to 1000 kannor (576 gallons) per annum. What, therefore, must a gallon of milk cost to a man whose cows give an average of only 200 or 250 gallons per annum!

It is unfortunate that Mr. Odelberg's accounts, when they give the value of the fodder consumed, do not give the quantities; and when the quantities are stated, as in the Vienna Catalogue, the values are not given. For the sake of comparison, however, I have calculated the value of the last-mentioned quantities at the rates given by Mr. Swartz in estimating the cost of rearing

calves, on page 217, and the result is an average quantity of food to the value of $4\frac{1}{2}d$. for every gallon of milk. Adding the average of the "other expenses" for the years 1865–66 and 1866–67, as given on pages 242 and 243, we get a total of $5{\cdot}95d.$, or very nearly $6d.$ per gallon, as the cost of production of milk in the year ending May 31st, 1872, on a basis of 100 cows, giving an average of 588 gallons per head during the year. Mr. Odelberg states that his milk was in that year sold at 28 öre per kanna ($6\frac{1}{2}d.$ per gallon), and at that price yielded a profit of $1l.\ 18s.\ 11d.$ per cow; therefore the cost of producing the milk must have been a trifle more than I have calculated, otherwise the profit (which of course includes the value of the manure reckoned as the value of the straw, as in the years 1865–66 and 1866–67) would have been about $9s.$ per cow more. It is, however, possible that the statement "all the milk was sold" is subject to a modification to the extent of the quantity usually consumed by the farm-labourers and their families, which would nearly balance the results of the two methods of calculation. These results are also confirmed by calculating the values of the quantities of food given for the year ending May 31st, 1873, the cost per cow being in each year between 10 guineas and $11l.$

It requires no argument to show that, if Mr. Odelberg's statements as to the cost of producing milk in the neighbourhood of Stockholm, are at all indicative of the average cost throughout Sweden under the best management, it is perfectly clear that milk-production in that country cannot pay even so low a rent as $13s.$ per acre, and leave a profit to the farmer. So far, indeed, is this from being the case, that there is a dead loss of $\frac{3}{4}d.$ per gallon on the milk produced in the most favourable of the two years in Mr. Odelberg's table, if $6d.$ per gallon represents the average net price obtained. The comparatively small farmers cannot be in the habit of comparing the returns from their dairy with the value of their labour, and of the materials that go into their cow-house for the production of milk, otherwise dairy-husbandry would not continue to hold its sway as the principal object of Scandinavian agriculture.

The best meat-growers in Sweden, as well as in England, hold that their fat beasts leave little or no profit except the value of their manure; but they are better off than the Swedish dairyman, whose cows, as it appears to me, generally entail a loss even after crediting them with their own estimate of their value as fertilising machines. I should, however, here observe that Mr. Odelberg's estimate of the value of the manure, namely, the original value of the straw, equal to very little more than $1l.$ per cow per annum, appears too low, although doubtless the value of the liquid manure is discounted in calculating the

cost of the hay and green food obtained from the irrigated meadows.

The foregoing argument should not be pushed too far, as the production of a sufficient quantity of milk, butter, and cheese for the wants of the community is both necessary to the consumer and profitable to the producer. But in Sweden nearly every farmer is a dairyman; it is therefore not surprising that the maximum price of milk obtained by a large producer close to Stockholm, the capital of the country, does not now reach 8*d.* per gallon. Then, although butter obtains a high price if it is of exceptionally good quality, the percentage of the total product belonging to that category is remarkably small; while inferior butter and skim-cheese are so abundant in the market, and therefore so cheap, that they do not pay the cost of production. The same may be said of whole-milk cheese, many dairymen having recently altered their practice to the making of butter and skim-cheese on that account. The fact is, the climate of Sweden renders dairying an expensive business, even under the most favourable circumstances; but under the method generally followed, the market for dairy products (except of the very finest quality) is overdone, and, owing to the combination of these conditions, dairying does not often pay.

Farm Labour.

Farm-labourers are generally hired by the year, and the agreement is made some time in advance of the period from which it is to commence. Thus arrangements are made in July for the year commencing the October following. The dates and scales of payment vary in different parts of the country, but the principle is the same throughout.

Labourers are paid in three ways, namely, entirely in money, or partly in money and partly in kind, or entirely in land. The last-mentioned, or "torp," system is the oldest. Some farms are entirely cultivated by "torpare," in which case about as much land is occupied by them as by the farmer. As a case in point, I may quote a farm (Gammalstorp, near Såtenys) recently purchased by a Danish gentleman, Lieut. Hansen. He has 960 acres in hand, and his labourers occupy 840 more; but hitherto he has paid no money wages except to a foreman, some cattlemen, and the dairymaids. The proportion of land allotted as payment for labour varies according to its quality, and to the value of the additional mountain-pasture, and of the wood for fuel. Both of these are most valuable in the more northern provinces. The amount of work given as rent for the land also varies with circumstances; but generally a labourer occupying 12 imperial

acres would have to furnish 150 days' work in the year, or, say three days per week, and also to supply horse-labour, if required, at a fixed rate of payment. In Seåne, where the agricultural system approaches most elosely to that of Denmark, some of the labourers have a house and not more than 3 or 4 acres of land, the cultivation of which is performed by the farmer's men and horses, the labourer in return giving 150 days' labour without payment, and as much additional labour as is required at 10*d.* per diem. The extent to whieh the "torp" system prevails in Sweden is indieated by the faet that 185,693 of the 295,983 agricultural holdings belonged to this class in 1872; and official figures show that there is no decided tendeney to substitute other kinds of payment for it. A few landowners, however, now give their old labourers leases of their small farms, and prefer to pay their successors in money.

The mixed payment of part money and part materials, is best illustrated by a few examples, in addition to Mr. Dickson's already given, the quantities being per annum.

	Mr. Swartz,* Wadstena.	Mr. Tranchell, Landskrona.	Count Platen, Kulla Gunnarstorp.	Mr. Insulander, Grastorp.
	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*
Money	3 11 $1\frac{1}{2}$	8 6 8	8 6 8	22 5 0
Rye	18 bush.	18 bush.	18 bush.	
Peas	$1\frac{1}{8}$,, (malt)	$4\frac{1}{2}$,,		
Barley	9 ,,	18 ,,	18 ,,	
Potatoes	$13\frac{1}{2}$,,	9 ,,	$13\frac{1}{2}$,,	
Swedes	$4\frac{1}{2}$,,			
Milk	160 galls.	210 galls.	160 galls.	
Salt herrings ..	1 cwt.			
Salt	4 galls.			
Firewood	4 cubic fms.	..	as required.	as required.
Coal	..	$22\frac{1}{2}$ bush.		
House	free.	free.	free.	free.

The last example given is nearly a pure money-payment: Mr. Insulander pays 25 men at that rate, and his remaining labour is partly provided by 15 or 16 students, and partly by peasants who furnish 5000 days' work in the year, at the average rate of 20 days' work per annum for every Swedish tunnland ($1\frac{1}{5}$ imperial acre).

In the more northern parts of Sweden the payment of a yearly labourer is sometimes arranged as follows:—in summer, 1*s.* 8*d.* per day; in winter, 1*s.* 4*d.*; house and quarter of an aere of garden rent-free; and enough hay for one eow through the winter, with

* The payment in this column is for 16 working days per month; for every additional day's work the labourer receives an additional 1*s.* $1\frac{1}{2}$*d.*

mountain-pasture in summer, both without payment. In Scåne day-labourers get 1*s.* 9*d.* per day in summer, rising to as much as 2*s.* 3*d.* per day at harvest-time.

In Norway yearly labourers are also paid on the same system, near Christiania the payment being 45*s.* a month in money, house and wood free, 7½ bushels of rye, 7½ bushels of barley, and 7½ bushels of potatoes. Daily labourers obtain from 1*s.* 9*d.* to 2*s.* 3*d.* per day in summer, and their cottage; and 1*s.* 9*d.* per day in winter, to as much as 3*s.* 8*d.*, when threshing, with 1*s.* 4*d.* for a woman to help. The system of land-payment also exists in a modified form: the peasant pays, say, from 5*l.* to 7*l.* per annum for his house and farm of about 7 acres; he works a stipulated number of days for his landlord, and is paid by the piece or the day according to arrangement; the rest of his time he works for himself.

The cost of farm-labour has increased very much in Sweden and Norway of recent years, owing to the demand for labour on the railways, in the forests, and in mining and manufacturing industries; but there does not appear to be any complaint of scarcity of hands. In the winter, the small farmers who possess no forests of their own work for those who do, and thus earn as labourers in the winter much more money than they gain as farmers in the summer. A highly-intelligent "peasant," so called, in Dalarne, told me that he cultivates about 36 acres of land on the usual seven-course system. He keeps 6 milch-cows, about 4 young cattle, 2 horses, and 18 to 20 sheep. The cows go to the Saeter, with a maid-servant, in the summer. On Sundays, from 20 to 30 horses are tied up in his steading, and he sells hay to their owners, who have come with their wives and families to attend church at Leksand from almost incredible distances. This man employs 6 labourers on his farm in summer; he keeps 2 maid-servants and 2 men-servants all the year round; and in winter, according to the season, he employs from 200 to 500 men in his forests. There also he works himself, and keeps a shop for the sale of provisions to those of his workpeople whose own supply has become exhausted. The wages vary from 2*s.* 9*d.* to nearly 4*s.* per day, but there is also a great deal of piece-work. A man with a horse and waggon will obtain from 11*s.* to 18*s.* per day, and this is how the small farmers turn the winter to profitable account. Their wives make clothes for the family from the wool of their own sheep; they eat the food of their own growth, taking provisions with them into the forest in winter; and thus they sell next to nothing off their little farms, and buy those necessaries that they do not produce in the summer with the money that they earn by working in the forests in winter.

The cottage of a Swedish farm-labourer contains, as a rule,

only two rooms occupied by the man and his family, namely, the living-room and the sleeping-room. It matters not how many rooms may be at the disposal of the family, only two are used by themselves, the rest being turned into a store-room, barn, &c. No matter what the number of the children, their age or sex, all sleep in the same room as the father and mother. On one farm which I visited, twenty of the labourers were under contract to provide a lad each, not less than seventeen years old, and these lads also shared the family room.

The best cottages that I saw in Sweden are those illustrated on pp. 235-237; the married men, without families, or with young children, can be accommodated on the ground-floor, having only one bedroom to each family; while those with children growing up can be accommodated upstairs, in suites of rooms, having two or three bedrooms to a family. Mr. and Mrs. Dickson have been very persevering in their efforts to make the practice of their people conform to the designs of the cottages.

About a quarter of an acre of potato and garden ground is usually attached to each cottage, or is marked out in a field at no great distance; but the custom varies very much according to the district, and the nature of the payment which constitutes the labourers' wages.

We have already seen that the short season for farm-work necessitates the keeping of a large staff of horses. The following lists of labourers kept on two large and well-managed farms will tell the same story. (1) A farm of 1460 acres, of which 360 are permanent pasture and 470 annually in artificial grass. The number of labourers are: 25 paid chiefly in money, "torpare" to the number of 5000 days, or 17 men at 300 days per annum, and 15 or 16 working students, besides dairy-maids and cattle-men to attend to 170 cows. These numbers amount to 4 per 100 acres of the total occupation, or 9 per 100 acres under corn, green crops, and bare fallow, in addition to the people employed in the dairy and about the cows. (2) A farm of 1200 acres, of which 60 or 70 are permanent pasture and over 500 in artificial grass. There are 33 married men, 20 lads, 3 unmarried men, and 5 women; also 5 extra men during the season for farm-work, 16 women during harvest, and about 40 boys, girls, and women engaged in cultivating 100 acres of sugar-beet. Excluding the harvest-women and sugar-beet people, there remain 66 persons, or $5\frac{1}{2}$ per 100 acres of the total occupation, and equal to 10 per 100 acres under cultivation in any year. If the 20 lads were reckoned as equal to 10 men the figures would be not very different from those afforded by the first-mentioned farm, if they were equally complete.

Agricultural Institutions.

In Sweden there are twenty-six county agricultural societies, partly supported by members' subscriptions, and partly by a Government grant of one-fifth of the amount of the spirit-duties annually paid within the district over which the Society has jurisdiction; and twenty-seven agricultural schools, educating 367 pupils in practical farming, at the cost of the State. The details of the work done by the societies (which includes the collection of agricultural statistics), and of the instruction given to the pupils at the farming schools, would lengthen too much this already long Report. I must therefore be content to give an idea of the higher Agricultural Institutions.

First of all, is the Royal Agricultural Academy of Sweden. This institution was founded in 1811, and not only discharges the functions of a scientific society, but also undertakes the management of an experimental farm, a chemical experimental establishment, and a museum of models of agricultural implements and machinery. It has the supervision of the agricultural schools and societies just noticed, and of the model dairies,* which are established in different parts of the country, as well as of the State herds that have been mentioned in a previous portion of this Report (p. 209).

The experimental farm is situated close to Stockholm, and is under the management of Mr. Juhlin Dannfelt. It consists of about fifty acres, farmed on an eight-course shift, viz., (1) bare fallow or green vetches; (2) winter corn; (3), (4), and (5) seeds; (6) mixture of oats and barley; (7) roots or green vetches; (8) barley. There are also about six acres of permanent grass, and about seventeen being laid down, over twenty acres of garden, and about 190 acres occupied by woods, rocks, hill-pastures, roads, buildings, &c. There are all necessary farm-buildings, a chemical laboratory, gas-works, houses for the manager and his subordinates, and every means and appliance necessary for the purposes of an establishment where every crop that is grown and every animal that is bred or fed are of an experimental nature. The results obtained are published from time to time in the 'Journal of the Royal Agricultural Academy,' the proper title of which is 'Kongl. Landtbruks-Akademiens Tidskrift.'

Travelling Instructors, in the employment of the Academy, give instruction, as required, in matters connected with cattle-breeding and dairy husbandry, as well as in those relating to wool-growing and sheep-keeping. The Academy also has a staff of Agricultural Engineers, who are accompanied on their visits by

* There are 13 model dairies, and 2 dairy schools supported by the Government.

pupils qualifying themselves for similar positions. The landowners who require the advice of any of these officials are required to pay only an honorarium of 5*s.* per diem, the cost of the journeys being borne by the State.

In addition to the agricultural schools already mentioned, there are two agricultural colleges, one at Ultuna, near the University town of Upsala, in the north; and the other at Alnarp, near the University town of Lund, in the Province of Scâne. The following brief sketch of the Alnarp College, presided over by Prof. Nathorst, will give an idea of the nature and scope of these institutions.

In the higher school there are sixty students, who receive a thorough training in the practice and science of agriculture, the complete course extending over two years. They pay about forty guineas the first year, and about thirty-two guineas the second, for instruction, board, lodging, &c. There are also thirty-six peasants' sons, who are instructed in practical farming; they work on the farm as labourers, neither pay nor are paid, but get food and lodging free of cost. In the farriery school there are from twenty to twenty-five pupils, who are taught the true principles of horse-shoeing, as well as their practical application. There is a dairy-school, at present attended by about half-a-dozen pupils; and from the 1st of January, 1875, there has been a school for the instruction of ten cattle-men in all that pertains to the management of stock, during a course of six months' duration.

Alnarp is a remarkably interesting institution, thoroughly well done in every department. No expense has been spared to obtain the best anatomical models and diagrams, the best illustrative specimens of natural objects, the most convenient laboratory appliances, and so forth. For instance, in the farriery school, there are illustrations of almost every conceivable kind of horse-shoe at present in use in different parts of the world, as well as others of antiquarian interest. There are also diagrams and models illustrative of the anatomy of the horse's foot, in health and disease. And perhaps more interesting than anything, from a practical point of view, there are collections of horse-shoes, which illustrate the school-history of each individual student. Commencing with the first shoe which the "freshman,"—an ordinary village blacksmith,—made on the first day of his school-career, according to his untutored practice at home, one could trace the gradual improvement in his attempts in proportion as he appreciated the instruction given him by the indefatigable Dr. Pehrsson. I quote this department in particular, because, so far as I know, we have nothing of the kind in England; but the same system of thoroughness is applied to every department of the college.

The farm attached to the college consists of 700 acres of good agricultural land, all of which has been drained 4 ft. deep, and 10 yds. apart; and there are 24 acres of garden. Nearly 100 acres are in permanent pasture, and the remaining 600 are cropped on a ten-course system as follows:—(1) half in green crop and half in rape-seed, stable-manure being applied to the former, and afterwards, from 225 to 300 lbs. per acre of a mixture of Peruvian and Mejillones guano in preparation for (2) wheat; (3) sugar-beet, the land having been manured as soon as it could be harrowed, and before sowing, with 300 lbs. dissolved guano, and 150 lbs. Mejillones per acre; (4) barley; (5) potatoes; with farmyard-manure, or peas and vetches without manure; but, in the latter case, the land afterwards dressed with 300 lbs. dissolved guano and 150 lbs. Mejillones per acre, in preparation for (6) wheat, generally, but sometimes spring-corn; (7) seeds, consisting of about 16 lbs. red clover, 4 lbs. white, 16 lbs. rye-grass, and 12 lbs. Timothy, sown the previous March; (8) seeds, ploughed up in July, and manured with 150 lbs. dissolved guano, and from 150 to 225 lbs. Mejillones per acre; (9) wheat or rye; and (10) half in bare fallow, manured with 300 lbs. dissolved guano and 150 lbs. Mejillones, in preparation for rape-seed, and the other half in spring-corn. The bare fallow is also given per acre 25 loads of sea-weed, which has been fermented in heaps and consolidated into a compost.

The following additional details will not only illustrate the climate and soil of Scåne, but also show that high farming produces good crops in that district. Wheat is sown from the middle of September to the first week in October, from 7 to 8 pecks of seed being used, and the crop averaging from 38 to 45 bushels per imperial acre. Rye is sown rather earlier, and yields as much as 45 bushels. Barley is sown in the middle of April, about 3 bushels to the acre; if after sugar-beet, the crop will be from 52 to 56 bushels per acre, but otherwise about the same as wheat. From 3 to 4 bushels of oats are sown per acre in the beginning of April, and the crop is usually about 45 bushels per acre. Rape-seed is sown at the end of July or first week in August, rather more than 8 lbs. to the acre, and yields about 45 bushels. Potatoes are planted the third week in May, and yield about 225 bushels. Mangolds and sugar-beets are got in during the middle of May, from 20 to 25 lbs. of seed per acre being used. The crop is from 16 to 18 tons per acre, mangolds being generally the higher figure; in 1873 the crop of sugar-beets was 16½ tons per imperial acre, and this year (1874) it looked larger. The cost of cultivation of sugar-beet at Alnarp is reckoned as follows, per imperial acre:—Manure, 2*l.* 10*s.*; expenses of cultivation (other than workpeople),

2*l.* 18*s.* 3*d.*; 22½ days' labour of men at 1*s.* 8*d.*, 1*l.* 17*s.* 6*d.*; 20 days' labour of women at 10*d.*, 16*s.* 8*d.*; harvesting, 1*l.* 2*s* 3*d.*; rent, &c., 1*l.* 3*s.* 4*d.* Total 10*l.* 8*s.*

The management of the cattle, and more particularly of the Shorthorns, has been already described on page 211; and a notice of the sheep has been given on page 221.

The total gross produce of the farm and garden amounts to 4750*l.*, or an average of over 6*l.* 10*s.* per acre. The Government is paid as rent of the whole estate attached to Alnarp, which is about 1300 acres in extent, 1800 bushels of rye, 1800 bushels of barley, and 1800 bushels of oats; the paymen is made in money, and is based on the average prices of those descriptions of grain for the past 10 years; it generally amounts to between 900*l.* and 1000*l.* per annum. The college also pays the taxes and other burdens, which amount to about 225*l.* per annum. Nearly 600 acres of land are let to college tenants; and the college receives a grant from the Government of nearly 1500*l.* per annum towards its expenses.

A similar college is established in Norway, at Aas, south of Christiania. It is not necessary to describe it in detail, as its essential features are not unlike other establishments of the same nature. The Principal, Mr. Dahl, and the Professor of Natural History and Veterinary Science, Mr. Thesen, were exceedingly kind in explaining matters to me, and in furnishing me with the annual reports on the work of the college. The farm consists of about 250 acres of arable land, in three portions, worked as follows:—

A.	B.	C.
1. Bare fallow, dunged.	1. Bare fallow, dunged.	1. Bare fallow, dunged.
2. Rye.	2. Rye or wheat.	2. Rye, sown out with clover and Timothy.
3. Roots, partly manured with artificials.	3. Red clover.	3, 4, 5, and 6. Grass.
4. Barley or oats, sown out.	4. Barley or wheat.	7. Pasture.
5, 6, 7. Grass.	5. Vetches, peas, beans, all cut ripe.	8. Oats.
8. Oats.	6. Barley or oats.	

The cattle are partly of the Thelemark breed, partly Ayrshires, and partly crosses. In the year ending July 1st, 1873, 16 Ayrshire cows gave an average of 416 gallons of milk each, while 27 Thelemark and cross-bred cows gave an average of 346 gallons each. In that year the total result of the cattle-farming, according to the published accounts, was a loss, although a profit is shown on the dairy department. This is arrived at, however, by charging the milk to the dairy at 5¼*d.* per gallon, a price at which 10,000 gallons were actually bought in. I should not omit to mention that pleuro-pneumonia was once

imported into Aas with an Ayrshire bull from Scotland. The bull arrived on September 21st, and the disease did not show itself until thebe ginning of November. One bull and one cow were killed, and seven other cows died of the disease before it finally disappeared. At the time of the Report to which I have been referring there were 31 students at Aas, 4 of whom received their education gratuitously; 21 of these students belonged to the lower and 14 to the upper school.

Another Norwegian institution of considerable interest is the Royal farm of Ladegaardsöen, close to Oscarshall, near Christiania. The management of this farm reflects great credit on the steward, Mr. Tveter, and his responsible superior, the Chamberlain Holst, a descendant of the inventor of the well-known Norwegian harrow. The farm consists of about 165 acres under the plough, and the park of the royal demesne, which furnishes grass for the cows in summer. These are bought at about four years old, in-calf, at about 7*l.* each. Old cows fetch nearly the same price as was given for them, if they are of the Thelemark breed, which is generally the case; but Ayrshire crosses can be made fatter and make more money.

The cows are kept in the house nearly all the year round, being fed in summer on cut grass, green vetches, and a little hay—from July 1st to September 30th, or thereabouts. The rest of the year they get hay and corn as already described on other farms. The calves are nearly all sold to the butcher at about 7*s.* each when a day or two old; but some of the best are kept on a little while and sold for breeding purposes.

The arable land is cropped with a view to the keeping of as many cows as possible, on the following seven-course shift; (1) one-third bare fallow, one-third turnips or potatoes, and one-third green crop, such as vetches; (2) rye after bare fallow, and barley after roots or green crop, both sown out with clover and grasses; (3) and (4) grass cut twice each year; (5) and (6) grass cut only once each year; (7) oats.

According to the official reports there were 39 cows on the farm in 1870, giving an average of 522 gallons of milk; and 43 in 1871, giving an average of 510 gallons; but I understood that 60 cows had been kept on the farm in 1874. The average price obtained by selling the milk in Christiania appears to have been $8\frac{1}{2}$*d.* per gallon in 1871, and about the same price during the years immediately preceding. This left a profit, according to the published accounts, amounting to 221*l.*; but those accounts do not show whether the rent of the 165 acres of arable land, the value of the grass from the park, and the interest of capital, &c., are taken into account in calculating the cost of the food given to the cows. The figures suggest that they are

included, for taking the cost of milk to be, as previously calculated, 6*d.* per gallon, this would leave a profit of 2½*d.* per gallon, or over 5*l.* per cow yielding 500 gallons of milk.

Taxation and Rural Affairs.

In Sweden the unit of assessment is an ancient division called a Hemman; but the respective areas of land constituting these divisions no longer represent equal values, as they doubtless did originally; and great dissatisfaction exists at the consequent inequality of taxation at the present day. There are also four classes of land, on each of which the burden of taxation differs in a greater or less degree, viz., (1) *Säteri*, (2) *Frälse*, (3) *Skatte*, and (4) *Krono Skatte*. The first of these, *Säteri*, is the regular freehold estate, and formerly could be held only by the nobility; it bears no direct taxes, and is not burdened with the provision of soldiers; but in case of invasion each Hemman of this class is bound to supply a horse for the purpose of national defence. The second class, *Frälse*, was also, in former times, a privilege of the nobility; but it has to furnish soldiers, or contribute towards furnishing them, according to the extent of land within the boundaries of the Hemman. The third and fourth classes are ordinary land without privileges, differing only in the fact that the *Krono Skatte* has been purchased from the Crown. The taxes on them are said to be heavy, and to depreciate the price of land; and the present aim of the peasants in the Riksdag is to get these taxes and the keeping of soldiers taken off the land and put on the nation generally.

All the land, except the Säteri, has to keep soldiers at present. The soldiers are provided with a house, a variable quantity of land, firewood, wood for fencing, uniform, and sometimes other perquisites. Legally they are obliged to work for the proprietors of the land, if required to do so, at the current rate of wages. For their house and other perquisites they do absolutely nothing for the farmer; but they attend drill two months in the year. If the keep of a cavalry soldier has been allotted to the land, a trained horse must be always ready, never put in harness, though he may be ridden. In some parts of Sweden it is thus by no means a bad thing to be a soldier. As an example of the soldier-keeping, I may mention Mr. Tranchell's farm, near Landskrona, consisting of about 1200 acres. It belongs to the second class; and although the proprietor has no highroads to keep in repair, he must keep four hussars in the manner already described; but by private arrangement with the men, he has managed to commute the perquisites of land, wood, &c., into a money payment.

The taxes levied in money are now paid by the landowners direct to the Crown, which in turn pays to the various local authorities what is due to them; but formerly these also were paid to the authorities in kind, each substance being redeemable at a certain price. All occupiers of land have to pay 1 per cent. income tax according to assessment; but in assessing the amount on which this tax must be paid, the burden of other taxes is taken into account.

Instead of a highway rate, all public roads, whether "high-roads" or "parish roads," are kept in repair by the occupiers of the land. The unit of administration for this purpose is the County Court district, by the authorities of which portions of the roads are allotted amongst the various Hemman, according, not only to the length and width of the roads, but also to the difficulty of keeping them in repair. As a consequence of this system the roads are unequally kept, and macadamising is the exception in the rural districts. As a rule, the roads of a Hemman fall to the level of the worst work that can pass the Government inspector; and where there is a long stretch of good road, it is because its repair devolves upon the owner of a large estate. The only redeeming feature of the system that occurred to me was the regulation that, in case of a severe snow-storm, the farmers in the district are bound to keep the whole of the roads clear, each furnishing his due proportion of men, horses, and waggons; although it may happen that the portions of the road blocked up by snow-drifts are otherwise under the charge of only a few of those called upon to assist in keeping it available for traffic under such circumstances.

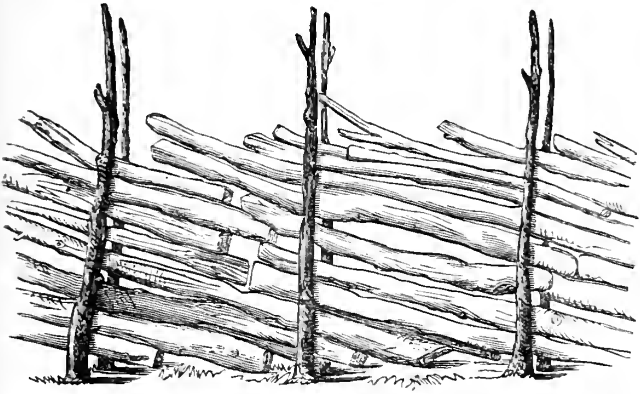
In Norway, the basis of taxation is the Skylddaler, each of which was originally of the estimated purchase-value of 1000 specie daler (225*l.*) as an investment; but the actual value of which is now very different. The local taxes include school, poor, church, and other rates, and amount to 10 or 12 specie dalers (45*s.* to 54*s.*) per Skylddaler per annum. The arrangements as to road-keeping are similar to those in Sweden.

The fences in Sweden and Norway are almost invariably constructed of wood, and the accompanying sketch (Fig. 18) will give a better idea of their ungainly appearance than any amount of description.

The recent increase in the value of wood and in the price of labour has raised the cost of these fences very considerably, especially in the south; and farmers are now relying to a large extent upon their open drains as divisions between their fields. The roads, however, are still bounded or crossed by these weird-looking fences; and the termination of each holding, at least, is still marked, as when the late Robert Chambers wrote 'Tracings

of the North of Europe,'* by a gate across the road, as if to protest against the improved methods of travelling which have of late years been so extensively adopted in Sweden.

Fig. 18.—*A Scandinavian Fence.*



A comparatively small proportion of the land of Sweden and Norway is pipe-drained, and it is something startling to see the deep and wide drains between the "lands" in most parts of the country. Even where subsoil-draining has been done, a certain number of these huge water-furrows are necessary, especially in the northern districts. The ice-bound land there becomes thawed in the spring with a marvellous suddenness, and if a sufficient number of these open-drains were not provided to carry off the surface-water without delay, valuable time would be lost in a country where the season during which field-work is possible, is, even under the most favourable circumstances, far too circumscribed. In addition to these deep open drains, it is usual to provide surface-channels for the water when the land is not pipe-drained, by using an årel furnished with a double mould-board, each having a comb-like wing to prevent the earth falling back into the furrows. These channels are not more than a few inches in depth, and are from 5 to 15 yards apart, according to circumstances. In appearance they somewhat roughly resemble the furrows at the junction of the lands in our ordinary system of ploughing.

During the year 1872, about 28,000 acres in Sweden were

* "There is one singular impediment in travelling: almost every few hundred yards—though often at very much wider intervals—a gate crosses the road, being part of the system of farm-enclosures, and having a regard to the exclusion of cattle from the corn-fields."—*Op. cit.* p. 55, 1850.

brought into cultivation, 9800 were drained, over 2100 acres of meadow were irrigated, and nearly 23,000 acres of land were marled.

In Sweden there is no limit to the permanent division of agricultural land as property farther than this: that at least three able-bodied persons must be able to obtain a living off each division. This rule does not, however, apply to the "torpare" belonging to a large estate, as their separation from it is only temporary, and is a matter of tenancy, not of ownership. In 1872, there were 252,776 owners, and 200,417 occupiers of cultivated land in the country. The total number of agricultural holdings was 295,983, of which 185,693 were held by agricultural labourers working more or less for other farmers. The annexed Table shows in detail how the land was subdivided, both as to ownership and occupation, in each of the years 1867–1872 inclusive.

TABLE showing the NUMBER of OWNERS and OCCUPIERS of CULTIVATED LAND in SWEDEN in the Years 1867–72.

	NUMBER OF OWNERS.				NUMBER OF OCCUPIERS.			
	4 Tunnland ($4\frac{4}{5}$ Acres) and under.	Between 4 and 40 Tunnland (48 Acres).	Exceeding 40 Tunnland, and up to 200.	Exceeding 200 Tunnland (240 Acres).	4 Tunnland ($4\frac{4}{5}$ Acres) and under.	Exceeding 4 and up to 40 Tunnland (48 Acres).	Exceeding 40 Tunnland and up to 200.	Exceeding 200 Tunnland (240 Acres).
1872	62,382	163,640	24,366	2,388	89,772	95,282	13,760	1,603
1871	62,517	162,820	24,707	2,577	92,812	98,576	13,946	1,732
1870	63,922	161,829	25,137	2,619	93,707	98,882	13,902	1,752
1869	63,257	158,689	24,716	2,537	91,069	95,677	13,535	1,499
1868	63,181	153,379	22,744	2,588	91,858	98,665	13,390	1,648
1867	57,755	146,819	22,664	2,697	92,849	97,092	15,097	1,823

It has been shown that the payment for labour in land requires an acreage about as great as that of the farm to be cultivated. In other words, the labour bill is equal to the rent, taxes, and tithes. This of itself is not an overwhelming proportion; but when it is remembered that about one-seventh to one-eighth of the arable land is generally unproductive, and the remainder is about equally divided between artificial grass and corn, the cost of labour as compared with the extent of the work to be performed is very large, but it is a necessity of the long winter. Then, as the horses consume one-third of the produce of the farm, and dairy-cows are fed on home-grown corn and hay—the chief object of the farming being dairying,—the sale of corn

off a Swedish farm is not very large. In fact, I was frequently told that a small farmer does not sell produce of every kind to the amount of 1*l.* per acre per annum off his farm; while on a well-managed large farm 3*l.* per acre may be considered a liberal estimate. In a few cases, where milk is sold at a high price to a neighbouring town, the return is larger, and no doubt the rent-value of the land is in proportion. For instance, Mr. Fogelmark, of Wall, near Gefle, who sells his milk at 9¼*d.* per gallon, realises 1220*l.* per annum for it, and sells corn to the value of 120*l.*, being together an average gross produce of 5*l.* per acre. This gentleman's farm is one of the best agricultural schools that I visited. It must also be remembered that the labourers are paid in money, house, garden, and keep for a cow. In Scåne the gross produce is larger than in the more northern provinces, the farms being more extensive and the climate better; and an average of 4*l.* 10*s.* per acre is said not to be exceptional.

The rent of land in Sweden and Norway is comparatively low, about 13*s.* per acre not unusually so; while 1*l.* per acre is occasionally obtained for good land. In Scåne the rents are higher, and I have been shown an exceptionally good farm rented at as much as 30*s.* per imperial acre. Tenant-farming is not, however, the rule in Sweden; but where it exists, the land is usually held on a lease of ten years if from a private individual, and one of twenty years if held from the Crown.

Mr. Dannfelt* has given the purchase value of land in Sweden at 5*l.* to 13*l.* 6*s.* 8*d.* per imperial acre, rising in Scåne to over 16*l.* per acre. Small lots of land, he says, cost 25 per cent. more than large lots. "The abundance of small occupations induces small farmers with insufficient capital to purchase them, in most cases at such a price that they have no money left to farm the land properly; the result is that their profits are less than if they had rented a farm proportionate in size to the extent of their capital." With regard to leases, he observes that they "seldom contain any stipulations as to cropping. It is sometimes covenanted that hay and straw may not be sold off the farm, and that no paring and burning shall take place; however, at the present time the right of selling fodder is granted, especially on farms in the vicinity of mining districts and large cities, where the sale of fodder for horses is a profitable item."

Conclusion.

Swedish and Norwegian farming, as described in the preceding pages, thus appears to be anything but a profitable

* Vide 'Continental Farming and Peasantry,' by J. Howard, M.P., Ridgway, 1870, pp. 97 and 98.

business. One of the keenest farmers whom I met in Norway calculated that his farm-profits had been in the last two years 9*s.* and 13*s.* 6*d.* per acre respectively; and we have already seen that the profits at Enskede for the three years 1865–68 did not average more than 5*s.* 6*d.* per acre. If the most enlightened men cannot make farming pay better than this, it is tolerably clear that the uninstructed peasant cannot obtain an equivalent for his labour, and for the rent-value of his farm. But as he has no rent-day to provide for, he does not realise this fact, and never thinks of asking himself whether his small profits repay him for the labour which he gives as rent, if his land is "torp," or are adequate interest for the capital sunk in the live and dead stock of the farm, and in the farm itself, if it is his own property.

I may be wrong, but it repeatedly struck me that as grass cannot grow in Sweden for more than five or six months in the year as a maximum, it must be relatively an unprofitable crop, although the necessity of a large area, under the prevailing system of dairy-husbandry, nobody can doubt. But this is one reason why dairy-husbandry is, as I understand it, unprofitable in Sweden and Norway, except under peculiar circumstances.

The prevalence of dairying also explains the almost universal practice of applying phosphatic manures to the corn-crops, when, that is to say, any artificial manure is used. Farmyard-manure is applied to fallow in preparation for rye; then the land is laid out in seeds for at least three years, all mown, and given to dairy-cows in the houses,—this is the national system, and it must rob the seed-land of its phosphates. The best farmers, therefore, seek to restore the condition of the land by applying a dressing of superphosphate to the first of the two or three successive crops of spring-corn that follow the ley. Except at Alnarp and one or two other places in Sweden, the use of nitrogenous artificial manures appears to be entirely unknown.

Some other prevalent practices are the result of the great distance of the farms from markets and centres of population and the difficulty and expense of transport of produce. Thus, the payment of the labourers to so large an extent in corn and other necessaries is in some districts an immense advantage to them. Similarly, many farmers cannot afford the expense of artificial feeding-stuffs, such as oil-cake, and therefore utilise their home-grown corn. Nevertheless, the table of imports for the five years ending with 1873 shows that the Swedish farmer is fully alive to the value of such materials as guano and oil-cakes, and that as the opening of new railways brings such aids to advanced agriculture within his reach he is not slow to avail himself of them. Until the last few years Swedish

farming was to a great extent self-contained; the occupier of land grew and consumed his own produce, for there was no market except in his immediate neighbourhood, on account of the mutual inaccessibility of the would-be buyer and seller. Such impediments are now being rapidly swept away. I believe, also, that the Swedish Parliament has at present under consideration the whole question of the taxation of landed property. If so, I am probably not too sanguine in anticipating that the Swedish railways will shortly be supplied with those necessary feeders —good roads; that Swedish farmers will be relieved from the irksome duties of road-making and soldier-keeping, by those burdens being commuted into an equitable money payment; and that the farming of Sweden, especially in relation to the production of meat, will acquire considerable development in the course of the next few years.

VI.—*On Cheese-making in Home Dairies and in Factories.* By J. CHALMERS MORTON.

THE history of the establishment of cheese-factories in Derbyshire was told by Mr. Gilbert Murray, of Elvaston, four years ago, in the seventh volume of this Journal.* The inferior quality and decreasing reputation of Derbyshire cheese, which is the staple agricultural product of a large portion of that county, the impossibility of making the best qualities of cheese with the commonly imperfect equipment of small Derbyshire dairy-farms, and the increasing difficulty and expense of the labour employed upon them, were the main causes of the movement. And to Lord Vernon, who had, at a meeting of the Royal Agricultural Society, so long ago as 1868,† moved for an inquiry into the working of the American factory-system of cheese-making; to Mr. J. G. Crompton, of Derby, the Hon. E. K. Coke, Messrs. Murray, Coleman, Sheldon, and others, whose time, labour, and money, were freely given in contending with the opposition which had to be encountered, is due the credit

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* The subject had been laid before an English audience so long ago as March, 1868, by the late Mr. George Jackson, of Tattenhall, Chester, who then read a Paper on cheese-factories before the London Farmers' Club. Reference must also be made to the Paper on the same subject by Mr. H. M. Jenkins, on December 9, 1870, before the Society of Arts; and especially to the lecture on "English Cheese-factories—how to establish and how to manage them," by Mr. J. Coleman, of Park Nook, Quorndon, Derby, before the London Farmers' Club, on February 6, 1871. Mr. Coleman's lecture and the speeches which followed it, reported in the Journal of the Farmers' Club (Salisbury Square, Fleet Street, London), are an admirable discussion of the whole subject. Mr. Jenkins had directed attention in the Sixth Volume (1870) of this 'Journal' to the applicability of the American factory system to English dairies.

† See vol. vi., p. 173: Second Series of the 'Journal.'

of the success which the movement has at length achieved. The two factories, at Longford and Derby, respectively, which were originally worked under the guarantee, by their public-spirited promoters, of a certain price per gallon for all the milk which they received, were soon followed by the establishment of four others, on the co-operative principle, in various parts of the county; and Mr. Crompton has now given me a list of 19 in five counties already built or about to be erected, which will be in operation during the coming year, capable of dealing with the milk of 7000 or 8000 cows. The time has therefore come when the factory movement may be acknowledged a success, and when a report, both of recent experience under it, and of its relations to the existing dairy practice of the country, may be useful.

In order to qualify myself for such a report I have visited all those cheese-factories which have been established in Derbyshire;* also one in Gloucestershire, and one in Cheshire, neither of which, however, can be considered quite to come within the designation which they claim; and I have seen factories which have been for some time in operation near Lichfield, Staffordshire, and near Weston-super-Mare, Somersetshire, respectively. Reports and statistics of many of these factories, in some cases very complete and full, have been placed at my disposal. I have witnessed a day's operations at some of them, and taken notes in the case of all of the process carried out in each. In order that the circumstances out of which they have arisen, or which they are intended to displace, may be understood and fairly represented, I have also visited for the purpose of this Report a number of dairy-farms in all the above-named counties —dairies of both average and noteworthy merit; and ample opportunity has been given me of discussing the whole subject, both with land-owners and with farmers who advocate the factory-system, and with land-owners, land-agents, and farmers who oppose it. Many excellent dairies in Cheshire, three in Derbyshire, nine in Gloucestershire, and three in Somersetshire, —one of them belonging rather to the North Wilts district, have been thus inspected; and everything that the experience of the dairy-farmer can suggest, for either the maintenance or the alteration of the old-established form of cheese-dairying, has, I believe, been carefully considered.

It is of course impossible, after all these discussions and inspections, now that the task of reporting them is before me, to affect that entire unprejudice with which it was desirable that the inquiry should be commenced. Having learned the history

* My best thanks are due to Mr. J. G. Crompton, of The Lilies, Derby, and to Messrs. G. Murray and J. P. Sheldon, for their guidance and assistance in Derbyshire.

and witnessed the results, and listened to the managers, of both factories and private dairies all over the country, an opinion has necessarily been formed; and fairly as it may have been arrived at, it can no longer be in an indifferent or impartial mood that one endeavours to express it. Experience has, I am bound to report, satisfied the expectations of those who first introduced the American factory-system into England. Manufacture on the larger scale has, in the case of milk as in that of all other raw materials, been found more economical and more profitable. A manufactured article of higher average quality, because of more uniform excellence, and consequently of greater value, has been obtained. The highest skill, hitherto engaged here and there in isolated farms on the produce of perhaps 40 to 60 cows, has been engaged in the manufacture of cheese from 400 to 600 cows. The best machinery and the cheapest power, unavailable in the case of small dairies, can be used when the milk of 20 or 30 such dairies is brought to one point for the purpose. Other advantages can also be named; and, together, it must be admitted that they more than counterbalance the risks and difficulties and costs which are incidental to the change.

Objections to the Factory System.

To some of these difficulties and objections I will first advert:

(1.) Some estates in dairy districts are already admirably equipped for the prosecution of the existing system of home-dairying; and an expenditure, in many cases both considerable and recent, would be rendered useless if the work of the dairy were henceforth to be carried on at a factory. And, where estates are not properly equipped, it is held with confidence by many, who unquestionably have the interests of the dairy farmer at heart, that these must suffer by any factory scheme which shall relieve the landowner of the duty of providing adequate accommodation on the several farms. Such accommodation is still the exception, not the rule, in dairy districts; and it is alleged, not without plausibility, that the factory-system which will save neglectful landowners from an otherwise necessary expenditure, may at the same time hinder the much-needed improvements of both homes and homesteads which would probably be undertaken if these dairy improvements had to be taken in hand.

Certainly an immense improvement in cheese-dairying is possible without resort to such a revolution in this particular industry as the cheese-factory involves. I had the pleasure of visiting a large number of farms on the Peckforton Estate, in Cheshire, where Mr. Tollemache has provided everything that

the most accomplished cheese-maker can desire in the way of equipment. The houses where the cows are kept in winter and milked in summer are conveniently near; ample room is provided for both milk and cheese—abundant space for storing and cooling the one, and for making and curing and storing the other; water is laid on at every point where it is wanted; admirable oven accommodation, required under the Cheshire system, is supplied; lifts for diminishing the labour of moving heavy cheeses are placed wherever useful; whey tanks are placed where wanted, and the waste whey, let off when exhausted of its cream, flows to a tank by the piggeries at a little distance—meal cistern and mixing cistern being at hand, and every help being thus given to diminish the labour of attending on the large number of pigs which are fed and fattened on all Cheshire dairy-farms. So great a saving of labour is effected by all these helps, that, in instance after instance which I visited, the whole work of the dairy was done by the mistress and her daughters—no paid dairy-maid being required. I saw many large and most comfortable homes, on farms of 40 to 60 cows a-piece, where both house and dairy-work were thus accomplished,—where high prices, 80*s.* to 88*s.* per cwt. (120 lbs.), for the cheese had been this year obtained,—and where, certainly, everything appeared the very perfection of cleanliness and comfort. Not unfrequently both the farmer and his wife had risen from the rank of farm and household labour. To deprive either of the accustomed daily task would in such cases be equivalent to an entire and most uncongenial change of life. In the case of an estate so perfectly equipped as this the question may be put, even with some degree of indignation, by a defender of home-dairying,—Why should you desire me to upset all these arrangements? why should I abandon a system under which the best cheese may be made, and by which the skill is perpetuated, on which the special agricultural industry of the county rests? To this one cannot but reply that such an estate as this does not offer a proper station for a factory.* It is because a high average quality of cheese is not generally made, because in the ordinary farm-dairy the much-needed equipment does not generally exist, because the cost and difficulty of labour are becoming year by year more felt, that dairy-factories are desirable; and it is especially in circumstances where they are thus called for that they

* I understand that on Lord Vernon's Derbyshire Estate, although the advantage of the cheese-factory system has been frequently urged upon the tenantry, no application has yet been made to the landlord for the erection of a factory. The fact is that in re-modelling the farm-buildings on this estate, the dairy arrangements, as on the Cheshire Estate alluded to above, have been made as perfect as the tenantry can wish.

are being established. Nevertheless, even on estates already fairly equipped, the practice of the best and most successful manufacturers ought not to be lightly thought of either by the landowner or by the farmer. The manufacturer knows that, whatever his expenditure on existing machinery may have been, to continue the employment of it when others are benefiting by the use of the more recent improvements will only result in loss; and whatever changes lead to profit he at once adopts at whatever cost. I am assured that the cheese made at the Longford factory, Derbyshire, during the past two years has been 10*s.* per cwt. better than that which was made by the contributors to that factory on their several farms in previous years. This, over a manufacture of 100 tons, means an increase in the annual receipts, over the area of only one considerable estate, of 1000*l.* per annum. If the great staple agricultural manufacture of any county can be improved so as to largely increase the value of its annual produce—the fund out of which rent and labour and the tenant all are paid,—it must be pronounced mere sentimental folly to oppose the improvement because estates have been recently equipped at some cost for the former less profitable process.

(2.) Most farms in our dairy districts are dependent to a considerable extent for both fertility and profit upon extensive pig-feeding, carried on during the season when whey is available. All such farms are, to some extent, thus dependent; and the despatch of the whole milk from them would, it is said, put an end to a very serviceable and profitable part of farm management. It is not always nor even generally that the whey is by itself a great source of fertility and profit, but it is the basis on which a large expenditure on other foods depends. Where no such expenditure is made, the whey is not considered of so much value, as when other food is bought to be consumed with it. Thus Mr. C. Bennett, a Gloucestershire dairy-farmer, quoted further on, considers the value of the whey to be generally over-estimated, and he would gladly give it to anyone who would fetch it, and pay him 1*l.* per cow per annum for it. On the other hand, Mr. Gibbons, of Tunley, Somersetshire, who has a dairy of from 50 to 70 cows, on an admirably managed farm, and who holds many prizes for the excellence of his Cheddar cheese, attaches the very highest value to the whey; on which he founds and justifies an expenditure of 300*l.* a year on meal and other foods for pigs, declaring that the deterioration of the fertility of his farm would be inevitable if this whey and meal feeding were to cease. Mr. Joseph Aston, too, of Brassey Green, Tarporley, Cheshire, who strongly advocates the retention of the home dairy management, declares that the whey is worth annually 35*s.* to

40*s.* per cow to the farmer, when it is consumed at home along with meal and other purchased food. And it may be named, as in some measure justifying this estimate of the value of the whey, that at the Rooksbridge cheese-factory, near Weston, where a large piggery is part of the establishment, those who send their milk receive, as payment for it, their aliquot share of the whole annual selling value of the cheese made from it, without any deductions for expense—being willing to give up the whey for the dairy expenses which they thus escape. These, in large dairies, amount to 1*l.* per cow, and in small ones, perhaps, to nearly double that amount per annum. This difficulty connected with the whey must, I think, in fairness be considered as a real drawback to the otherwise unquestionable merit of the factory system. But it will not be considered fatal to it; the whey will either be brought back to the farm which supplied the milk, and then it is only the additional cost of carriage which has to be considered; or it will be sold at the factory to the nearer farms; or it will be used in pigsties near the factory. In the first case, at some of the factories the managers permit the use of the same vessels for the whey as have brought the milk—which of course involves the need of special care in cleaning them between times. In both the other cases, the value of the whey returns, more or less perfectly, to the farmer, who will then, in respect of the alleged loss of the fertility due to the consumption of the whey, be only standing in a similar position to that of many other occupiers of land, in respect of their grain and other produce which they might consume at home, to the great increase of the fertility of their land, but which they prefer to sell; taking care of the productiveness of their farms, as they are quite able to do, in other ways.

(3.) An objection, almost certain to be fatal, if not to the adoption of the factory system in a district, at least to any patronage of it by individual occupiers, will, no doubt, be made on particular farms by those who are already in the habit of making the very best quality of cheese in the market. They will not be satisfied with only the high average price which they may expect by sending their milk to a factory. But this objection can exist only in the exceptional cases of those who have reason to be proud of the name and fame of their several dairies. On the majority of farms the cheese made is below the average quality; and by sending all the milk of a district to a factory there is the advantage gained of putting the cheese-making of the whole country-side in the cleverest hands that can be hired.

(4). I must add to these objections that the carriage of the milk is a clear addition, which the factory system involves, to the ordinary labour of the farm, already generally heavy enough; and of course, if the balance of advantages between the home

dairy and the factory be so close that the few shillings a week which are thus involved will turn the scale, there can be no chance of a factory succeeding. As a matter of fact, this additional labour does not hinder milk being sent to factories from farms four miles off. This is the case, I believe, both at Lichfield and at Longford. The cost is diminished in some cases by one of the more distant senders undertaking to pick up the milk of other contributors on his way, one horse and one lad being thus engaged for all, instead of one for each. The cost is thus at once distributed and diminished; but the principal alleviation, and practically the annihilation of this expense will only be attained when factories are multiplied sufficiently. The land within the radius of a mile exceeds 2000 acres, an area which, in a dairy district, may contain at least 600 milking cows, quite enough to justify a factory, which need not thus be farther than a mile from any of its contributors.

One would not, however, lightly consider an objection to the increase of labour on our dairy-farms, for it must be remembered that the milking of the cows always prescribes a very considerable minimum; and there must, in any case, always be hands enough to accomplish this. If only this process could be accomplished by machinery, there would at once be a greater readiness to acquiesce in any proposal for lessening the other necessary labour on such farms. Surely the process is not beyond the limits of artificial contrivance. If by offering even the largest prize for which they have any precedent, the Royal Agricultural Society could obtain a thoroughly efficient artificial cow-milker, it would make a most advantageous use of its funds—rendering an immense service to all dairy-farmers, and making them readier to unite for the further economy of labour which the factory system enables.

The Advantages of the Factory System.

Some of the advantages which are claimed for the Factory system of cheese-making have been already gathered from this discussion of the objections which have been made to it.

(1.) The importance, just alluded to, of putting the manufacture in the hands of the cleverest makers, places this among the chief of them. The milk of 20 to 30 dairies, manipulated with all the aid of the best apparatus, by the cleverest of the 20 or 30 dairymaids through whose hands, in generally poorly equipped dairies, it has hitherto passed, is certain to result in a higher quality and consequently greater value of cheese upon the whole. To this agrees the report of the cheese-market ever since the Derbyshire cheese-factories have been established; and we may

quote particular illustrations to the same effect. The average price of the cheese made at the Windley Hall Factory, near Derby, was 4*l.* 3*s.* 7½*d.* per cwt. of 120 lbs. over 34 tons 2 cwt. 1 qr. made in 1873; and 4*l.* 1*s.* over about 42 tons made in 1874. At Longford the price was 4*l.* 2*s.* 4*d.* over 86¼ tons in 1873, and 4*l.* 2*s.* 3¾*d.* over 84½ tons (all that had been sold at the date of my information) in 1874. It is impossible to get the corresponding figures for equal quantities of cheese made in private dairies; but keeping in mind how few of the whole number of sales reach the highest figures given in any market quotation, something may be learned from the following prices, taken from the 'Agricultural Gazette,' as representing the market prices of cheese, month by month, last year, in Derbyshire, at factories and private dairies respectively.

PRICES OF CHEESE IN DERBYSHIRE,* 1874.

DATE.	HOME DAIRY CHEESE. Per Cwt. of 120 lbs. Lowest Price.			Highest Price.			FACTORY CHEESE. Per Cwt. of 120 lbs. Lowest Price.			Highest Price.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
August 22	3	0	0	4	0	0	4	0	0	4	2	6
September 12	3	8	0	4	1	0	4	0	0	4	5	0
,, 26	3	8	0	4	4	0	4	0	0	4	6	6
October 10	3	5	0	4	4	0	4	2	0	4	7	0
,, 17	3	5	0	4	4	0	4	3	0	4	6	6
,, 24	3	5	0	4	9	0	4	3	0	4	7	0
November 7	3	0	0	4	2	0	4	4	0	4	7	0
,, 28	2	15	0	4	4	0	4	4	0	4	10	0
December 5	3	8	0	4	2	0	4	4	0	4	6	0
,, 19	3	8	0	4	2	0	4	4	0	4	6	0
,, 26	3	0	0	4	4	0	4	1	0	4	6	0

The above quotations commence only in the month of August but the difference in the value of home-made and of factory chees is even greater in the earlier months. The first make of chees in home dairies—"Fodder or Boosey"† cheese as it is callec when the cows are still in the house—is generally of inferic

* The actual prices named in any case may be lower or higher than those whi could be quoted of Cheshire, Somersetshire, or Gloucestershire. It is not eith as vaunting or lamenting Derbyshire experience that the figures are quoted. Th prices are stated simply for the comparison which they give of home and facto cheese.

† "Boosey," *i.e.*, made while the cows are still in the house. "Every cow its own boose," or stall, is a phrase perfectly understood in Derbyshire cowhous

quality, owing partly, in all probability, to the small quantity of milk available, and the consequent need of using old curd to make up a full-sized cheese. Whether this be the explanation or not, I am informed that the cheese made in large quantity in the vat of a factory, is good from the very outset of the season, and remains of nearly uniform quality throughout the year.

In addition to the increased value of a make of cheese, owing to uniformly high quality, which is realized when the milk is taken from the home-dairy and sent to a factory for manufacture—there is an increased value owing to the larger quantity of cheese which undoubtedly is made from a given quantity of milk at factories, owing to the more uniform and systematic manufacture of the curd, which is possible where large quantities are dealt with, as compared with private dairies; but to this some reference will be made hereafter.

(2.) The diminished cost of cheese-making at which this higher value is obtained is another considerable advantage of the factory system. This will be related in more detail when referring directly to factory management and experience. At present I may say that at the Windley Hall Factory, to which seventeen dairies contribute their milk, upwards of 50 tons of cheese (58 tons 17 cwt. 3 qrs. 3 lbs. of green cheese) were made last year by a manager (whose salary is 75*l.*), his assistant (29*l.* 14*s.*), and extra assistant (11*l.* 13*s.*). The materials used cost 33*l.* 11*s.* 9*d.*, petty expenses 7*l.* 9*s.* 5*d.*, account-keeping 10*l.*, rent 40*l.* The mere labour thus amounted to 2*s.* per cwt., and the total cost of manufacture to 3*s.* 10½*d.* per cwt. If we compare with this the case of a farm of 30 cows making even 4 cwts. a-piece, putting the cost and keep of a dairymaid at only 40*l.* a year, and charging only three-quarters of it, or 30*l.*, against 112½ cwts. of cheese, we find a cost of 5*s.* a cwt. in labour alone, even on this moderate valuation of the labour, whether undertaken by the mistress or a servant. No wonder that Mr. Joseph Needham, of School Clough Farm, a contributor to the Holms Factory, near Ashbourne, declares that in the increased value and diminished cost of his cheese made from 30 cows he has gained 80*l.* a year by sending it to the factory.

(3.) It cannot be alleged that I have over-estimated the cost of the work in an ordinary dairy at 30*l.* a year for 30 cows; but if it be objected that this will in general be undertaken by the farmer's wife, whose services hardly admit of a money valuation, then, except from those who pronounce hard work to be in itself desirable, it may be claimed as one benefit of the factory system that it puts a stop to the undue labour—drudgery it must often be in times of weakness or imperfect health—of the mistress of an ordinary home cheese-dairy. This would not, however, be

allowed by any of those to whom I spoke upon the subject during the round which Mr. Tollemache was kind enough to take me amongst the farm-houses on his Cheshire estate; but probably the truth is fairly told in a letter upon the subject which I received some years ago, soon after a speech by Lord Vernon in which this particular service of the factory system was insisted on—that it would put an end to the drudgery of the farmer's wife. Mrs. Charles Bennett, of Stone, Gloucestershire, one of the best cheese-makers in the county, wrote to me as follows:—

"During the cheese-making season I find it needful to be in the dairy by half-past five o'clock in the morning for an hour. Then there is an hour's release for breakfast. By that time the curd will be fit for breaking. Then there will be making it into cheese, which will take from two to two-and-a-half hours, excepting intervals of not more than a quarter of an hour twice during this time. It will then be about ten o'clock. If I have a good servant, I can then leave the cheese to her; and it will be necessary for her to go to it in an hour to dry-cloth it, and again in two hours to salt it. With her assistance I have done with it till one o'clock. Then if cheese be made twice a day, this has all to be repeated, commencing at four P.M. Those who profess that they cannot see what farmers' wives would have to do if they gave up cheese-making, must forget that such people are very frequently the mothers of families, and have them to attend to besides their usual housekeeping duties. I think there is really too much devolving on a farmer's wife who looks well to her dairy, and wishes to do her duty in a domestic way. Now that our family has grown up, and can share in the work, I do not find it very burdensome, and of course we take a pride in it. But there are many of us who would be glad, nevertheless, if the work could be done as well without our doing it. When I commenced cheese-making, about twenty-four years ago, good dairy-girls were not so scarce as now. At the present time it is difficult to get a respectable servant who will undertake the work."

Mrs. Bennett evidently thinks that heavy labour is not in itself a good. On the contrary, although there are many incidental compensations, it is in itself an evil; and one of the greatest benefits which this generation has experienced is the gradual lightening of this evil by the substitution of horse and steam for hand. Why should not a benefit which has been so obvious on the farm and field be welcome in the dairy? And why should the wife of a dairy farmer, who has been relieved by the cheese-factory system, be supposed more destitute of occupation or home interest than the wife of another farmer who may have never had a dairy to direct?

(4.) It is a distinct advantage of the factory system of dealing with the milk of a dairy-farm that every contributor can at any time draw upon the funds of the Association for a certain proportion of the value of the milk which he has delivered. The co-operative factory does a most legitimate and beneficial banking business in this way. And if it be alleged that this is no other service than has all along been rendered to needy tenants in the dairy districts by cheese-factors, who have always been

ready to keep an account current with those whose cheese they purchase—lending money in advance of sales on the understanding that the cheese is being made for them, the essential and important difference between the two must be pointed out. In the one case the borrower is in no sense whatever the servant of the lender; he does but obtain, on interest, in advance, a portion of what already is his own—the amount ultimately coming to him being in no way influenced by any limit upon his power of sale, such as exists where the factor is the creditor. In the latter case the independence of the maker certainly is to some extent compromised, and his power of making a full price is to that extent diminished. As Mr. H. M. Jenkins stated four years ago on this subject before the Society of Arts:—"It is far better for the farmer to have a factory for his bank than a factor for his banker."

(5.) Lastly, it is an incidental advantage of the factory system in some districts, that an organisation of this kind lends itself most conveniently at certain seasons to the demands of the milk trade. The direct supply of milk to consumers is the most profitable use that can be made of it; and it has been advantageous in more than one instance to the "patrons" of a cheese-factory, that on a demand by milk-sellers in London, the whole daily delivery, properly cooled in the vats of the factory, has been at once despatched to consumers at the higher price which could be thus obtained for it. And it is not improbable that the combination of cheese-making with the milk supply may hereafter be found the most profitable occupation of a factory in suburban districts, including not only ordinary dairy-farms, but lands where grass is grown by sewage irrigation.

The various recommendations of the factory system, and the objections to it which have been thus enumerated, do not in all probability cover the whole of the ground under discussion between its advocates and opponents; but these are enough to determine its adoption or rejection. They have, I hope, been stated fairly; and it is plain that the balance of advantage, so far as the discussion has been conducted here, is distinctly with the factory—those rare cases only excepted when a dairy property is in the hands of at once a public-spirited and energetic owner, and a thoroughly accomplished and equally energetic body of tenantry.

The progress, however, of the factory system will depend, not on an argument of this kind, but upon the actual results attained under a sufficiently long experience of it; and this, therefore, I shall immediately proceed to describe.

First, however, it has been thought advisable to give some

account of the modes of cheese-manufacture in our principal dairy districts, if only as an illustration of the fitness of the factory system to the manufacture of cheese on any of the several methods.

Cheese-making in Home Dairies.

(1.) The Cheddar System.—This I will describe as it is carried on at Marksbury, upon the farm of one of the best makers in England. Mr. Harding, of Marksbury, is already known to readers of this Journal (see vol. xxi.), and he is also well known to cheese-makers in Ayrshire and other counties and districts which he and Mrs. Harding have visited on the invitation of Agricultural Societies and others, for the purpose of giving instruction in the manufacture of this kind of cheese. Mr. Harding is now disabled by illness, but he took great interest in the object of my visit to Marksbury last October, when I witnessed the process of cheese-making on his farm, and learned from Mrs. Harding and her son-in-law, who is now associated with them in the tenancy of the farm, the full details of their mode of cheese-making.

The morning's and evening's milk are together brought to a temperature of 80°, more or less, according to the temperature of the night. If that has been warm, a temperature of 78° will give as great effectiveness to a given quantity of rennet as one of 82° or 84° in cases where the milk has been at a lower temperature for some hours of a cold night. The evening's milk, having been placed in several vessels during the night to cool, and being stirred at intervals during the evening, is skimmed, and the cream, with a portion of the milk, is heated up to 100° by floating it in tin vessels on the boiler, and the whole of it is poured into the tub—into which the morning's milk is being also strained, through a proper sieve, as it arrives—so as to raise the whole, as I have said, to from 78° to 82° Fahr. The rennet, made from two or three dozen vells, in as many quarts of salt water, and allowed to stand three weeks, is added—half a pint to 100 gallons—and the curd sets in about an hour. The small vells of Irish calves, which are killed at a week old, are preferred, and they should be 18 months old before use. The curd is cut with a single long blade to and fro throughout its depth, in lines forming a 4-inch mesh upon the surface, and the whole mass is gently turned over from the bottom with skimming-dish and hand. The whole is then again worked throughout with a 'shovel breaker'—a four-fingered paddle, with wires across the fingers—great care being taken to do it gently, so that

the whey shall not become too white. The curd is thus broken up into pieces not much larger than peas, and at least half an hour is taken in the process. Hot water is then let into the space around and below the cheese-tub, and the whole is raised to 100° Fahr.; and this too is done gradually, so as to raise the whole by degrees, not heating any portion to excess. This also takes half an hour. The hot water is then drawn off, and the curd is then stirred by hand and skimming-dish for another half an hour in the midst of this hot whey, being at length reduced to a mass of separate bits the size of small peas. The whey, after settling for half an hour, is then drawn off to its vat, where it stands about 6 inches deep, and is skimmed next day, yielding a butter, which should not exceed in quantity 6 to 8 ounces per cow per week. The curd stands half an hour after the whey is drawn off, and it is then cut in four or five pieces and turned over and left for half an hour, after which it is again cut and left for a quarter of an hour. After this, it should be in the slightest degree acid to the taste. If allowed to become too acid, it will not press into a solid, well-shaped cheese, but will be apt to sink abroad misshapen. It is now torn into pieces by hand, and left to cool; and thereafter it is packed in successive thin layers in the vat, whence, after being pressed for half an hour, it is taken out (it is now probably mid-day), and broken up by hand, and allowed again to cool. Then—when cool, and sour, and dry, and tough *enough* (all this of course being left to the judgment of the maker)—it is ground up in the curd-mill; 2 lbs. of salt are added to the cwt. of curd, and the whole is allowed to cool, and as soon as cold, it is put in the vat and taken to the press. It is now probably 3 P.M. The pressure on the cheese may be 18 cwt. The cloth is changed next morning. A calico coating is laced on it the second day, and on the third day the cheese may be taken from the press, placed in the cheese-room, bandaged, and turned daily, and at length less frequently. The cheese-room should be kept at nearly 65° Fahr. The cheese will not be ready for sale for three months.

The process lasts nearly all the day, but it produces the best cheese in the world, and it is everywhere extending. Taking its name from a single parish, it now prevails all over North Somersetshire, and is gradually extending into Wiltshire. Many dairies adopt it in Gloucestershire. Some of its characteristic details are followed in Cheshire; and in Lancashire, and Ayrshire and Galloway it is well known.

The costs of a dairy in this case amount to 50*l*. a year for dairymaid and her keep; 25*l*. a year for a girl; and a man's help two hours a day, which can hardly be put at less than 10*l*. a year more—or 85*l*. in all. This amount of help would be

needed for a dairy of 40 cows, but it would be equal to the work of a dairy twice as large. Of course the farmer's wife here, in the case of small and even of large dairies, takes a large portion of the direction and of the labour herself; but estimating it, by whomsoever done, at its proper wage value, the cost in the smaller dairies must be nearly 2*l.* per cow, or at least 10*s.* per cwt. And to this agrees the experience of Mr. Smith, of Nupdown Farm, who has introduced the system into the Vale of Berkeley. He estimates his cost, for a dairymaid and girl at 80*l.* per annum for a dairy of 44 cows on a farm of 153 acres. He makes only about 8 lbs. of whey-butter weekly, and showed me a remarkably fine floor of cheeses—24 of which, weighing 22¾ cwt., he had just sold.

In addition to Mr. Harding's dairy at Marksbury, I also saw the process as carried out at Tunley, near Bath, by Mr. Gibbons, a son-in-law of Mr. Harding, whose daughter, Mrs. Gibbons, had, among other distinctions, won the gold medal of the French Exhibition in 1865, for the excellence of her cheese manufactured on this system. The Cheddar cheese is made of various sizes, from 70 to 120 lbs., the object being to make all the milk of one day on a farm of 30 or 40 cows into a single cheese.

(2.) THE CHESHIRE SYSTEM, which varies somewhat in different dairies, I saw in operation on the farms of Mr. Joseph Aston, of Brassey Green, near Tarporley, Mr. Robert Ankers, of Huxley, and Mr. Joseph Siddorns, of Broxton. Cheese is made only once a day. The evening's milk is placed not more than 6 or 7 inches deep in tin vessels, to cool during the night, on the floor of the dairy; it is skimmed in the morning, and a certain portion is kept for butter—in early summer only enough perhaps for the use of the house, but in autumn more, and in some dairies at length nearly all is thus taken for churning. The skimmed cream, with a portion of milk, is heated up to 130° of Fahr. by floating the tins which hold it on the boiler: quantity enough being taken to raise the whole of evening's and morning's milk together to 90°, or thereabouts. The rennet used had been made the day before; 8 or 9 square inches of vell, standing in a pint of salt water, kept in a warm place, making rennet enough for 100 gallons of milk. Mr. Siddorns, who had taken accurate weights and measures, found that five pieces of vell, each weighing 60 grains, standing in 12 ounces of water during the day in a temperature of 70°, yielded the proper quantity for 50 gallons of milk. The Irish vell is used, being from very young and wholly milk-fed calves.

The curd is set in about 50 minutes; it is then cut with the usual curd-breaker, a sieve-shaped cutter, very slowly. The

whey is syphoned, pumped, or lifted out as soon as possible; but before it is all removed a portion is (on some farms) heated and returned to the tub, and the curd is left in this hot whey half an hour. The whey is then drained away and the cheese left to get firm. When firm enough to stand on the hand in cubes of about a pound weight—this is Mr. Siddorns' illustration—without breaking asunder, it is lifted out on the drainer, a false bottom of rods in a long tub with a stop-cock to it, and there left covered up for 45 minutes, after which it is well mixed by hand with $3\frac{1}{2}$ to $4\frac{1}{2}$ lbs. of salt per cwt.—then allowed to stand with a light weight upon it for about three-quarters of an hour longer, being turned over once or twice during the time, after being cut into squares with a knife. It is then twice passed through the curd-mill, and put into the vat at once, a cloth being pressed first into the place by a tin hoop and the salted curd being packed gently by hand within it. In some dairies the salt is not added till after the curd has been thus ground in the mill. As to the quantity of salt to be added, that must be determined by judgment of the quantity of whey which is likely to pass from the press. In one case mentioned by Mr. Siddorns, 6 lbs. of salt were added to 118 lbs. of curd, which, however, lost as much as 48 lbs. of whey in the after-process, which necessarily carried off a large quantity of the salt which had been added. The vats will hold a cheese of 70 or 80, up to 100 lbs.; and tin hoops, placed within them, are used to eke them out and give capacity for a larger quantity of curd, if necessary. In an ordinary Cheshire dairy all the milk is ready in the cheese-tub by 7 o'clock in the morning, the curd is set by 8, it is ready for the drainer by 9, and it may be put into the vat soon after 11. After standing in the vat, with a weight upon it, from one to two hours, according to the state of the weather, it is turned over and put into the oven—a warm chamber in or near the brickwork of the dairy-chimney—where it remains at a temperature of 90° to 100° during the night. Both when in the press and here the cheese is skewered, skewers being thrust into it through holes in the vat, and every now and then withdrawn, so as to facilitate the drainage of the whey. The cheese is taken out of the vat next morning and turned upside down in a fresh cloth. It is in the press three days, and it is turned in the press twice a day, being dry-clothed each time. It is then taken out, bandaged, and removed to the cheese-room, where it is turned daily, or at length only occasionally, until it is ready for sale. In some dairies all skewering is dispensed with, and no pressure is used at the time of making, nor for two days afterwards; but the whey is allowed to run out of its own accord. Cheese manufactured in this way requires from 5 to 7 days in drying, but matures more quickly for market.

The cheese varies considerably in quality throughout the year, the earlier make of March and April being considerably less valuable than that of summer and early autumn. Some of this varying quality is owing to quality of milk, and some to the necessity of holding a portion of curd over from day to day when the quantity is insufficient to make either one, or it may be two, full-sized cheeses daily. In such cases it is common to make one full-sized cheese and hold the remainder of the curd over till the next day, keeping it wrapped up on the drainer or pan, and grinding it up in the curd-mill along with the curd of the next morning.

The quantity of cheese made varies from $3\frac{1}{2}$ to 4 cwt. per cow per annum on good farms. The quantity of butter made in a good dairy will not be half a pound per cow in the early summer from both whey and milk; in the autumn, the milk being richer, considerably more may be made without diminishing the quality of the cheese. Mr. Aston, of Brassey Green, is an advocate of the private dairy system:—"The labour is the ordinary farm life to which the mistress and her servants are all accustomed. The cost of fuel which might be saved were the milk sent to a factory would be immaterial, for all dairy vessels would in any case require a daily scalding, as usual; the whey which, except at the cost of much inconvenient labour, would be lost to the farm, is the main agent in pig-feeding, and the loss of the pig-manure would be a great injury to the soil. The whey is valued on Cheshire farms at nearly 2*l.* annually per cow. The whole equipment of farm-house and dairy, often costly, and in the case of some Cheshire estates, very perfect and complete, would go for nothing. The price at which in the Derbyshire dairies the annual profit shows that the milk has been sold, is less than that which can be made of it in many Cheshire dairies. No farmer making good cheese would be willing to part with his milk for $7\frac{3}{4}$*d.* per gallon."—This is Mr. Aston's statement.

3. The Gloucestershire System, as ordinarily conducted, may be gathered from the practice on Mr. Charles Bennett's farm, near Stone, in the Vale of Berkeley. There is here a dairy of 40 to 48 cows, on a farm of 260 acres, of which 32 are arable. Cheese is made only once a day. The evening's milk is placed in the cheese-tub and in other vessels, standing not more than 3 inches deep during the night, so as to lose its natural heat as quickly and completely as possible. It is there stirred occasionally during the evening and the last thing at night to check the rising of the cream. Any cream that has risen in the morning is skimmed, and so much as it is desired to keep for butter is set apart; the remainder, with enough of the milk, is floated in tin

vessels on a boiler until as hot as the hand can easily bear—probably about 110° Fahr.—and is poured with all the evening's milk and the morning's, as it arrives from the yard, into the cheese-tub, enough being heated to raise the whole to about 84° Fahr.

The cheese-tub is a tin vessel capable of holding about 150 gallons, and provided with a stop-cock by which its contents can be drawn off. When all the milk is collected the rennet is added—from one to two half-pints according to the quantity of milk—about a pint to 100 gallons being the proper quantity. This rennet is made four or five times during the season, a dozen vells and half a dozen lemons being added to 5 or 6 gallons of brine for the purpose, and placed in a covered stone jar for use. The curd is set in an hour; the process of breaking is performed by a sieve-like set of wires, with about an inch mesh, which is fixed at right angles to its handle and pushed down through the mass very gently in successive places all over the surface of the curd. The curd is then gently lifted and moved from the bottom and corners of the tub with hand and skimming-dish, and the cutter used again. This process takes in all about half an hour, and the curd is then allowed to settle, and half the whey is baled out. A portion of this whey is then heated to 120° Fahr. and returned to the tub, again raising the temperature there to 84° Fahr., and then it lies for a quarter of an hour, after which the whey is drawn off by opening the stop-cock. After settling into a firm mass, the curd is cut and turned in pieces over one another on the floor of the tub and allowed to drain; it is thereafter placed in cloths in the vats, of the size corresponding to about eight cheeses to the cwt., and there it is pressed for a quarter of an hour. It is then taken out and put through the curd-mill and immediately vatted again. It is now about 9 o'clock or half-past 9. The cheeses are taken out in one hour afterwards, the vat is wiped and the cheese replaced in a dry cloth. About three hours later it is again taken out, and this time rubbed with salt, which salting process is again repeated at night.

In large dairies this work is done twice a day. If any butter is made in these dairies, a certain portion of milk has to be set apart for the purpose; otherwise the whole of the evening's milk at once goes into the cheese-tub, such a portion being heated as suffices to raise the whole to the temperature required, after which the rennet is added and the morning's proceedings are repeated; and the labours of the dairy, beginning at 5 in the morning, are not over till 8 or 9 at night.

On two or three successive days the cheeses are taken out of their vats, again rubbed with salt, and returned to the press. In three days they are taken to the cheese-loft and there turned, at

first daily, afterwards at longer intervals. They are ready for sale in six or eight weeks. It is the practice in this dairy of 40 to 48 cows to take about 25 lbs. of milk-butter a week, and the whey yields 10 or 12 lbs. in addition. The difference in quantity and quality of cheese, owing to this quantity of butter being taken, is more than balanced, in Mrs. Bennett's opinion, by the receipts for the butter thus made.

The annual make of cheese varies, of course, from year to year, rarely amounting to 4 cwt. per cow, while 3½ cwt. would be considered a poor yield. The prices realised, when the best cheese of the summer months has commanded 70*s.* per cwt. (112 lbs.), have varied from 56*s.* for "fodder" cheese, made in March and sold in May, to 60*s.* or 62*s.* per cwt. for April-made cheese, sold in May and June, and 66*s.* or 68*s.* per cwt. for summer-make. The whey on this farm is not considered of much value, and Mr. Bennett would gladly part with it for the 1*l.* per cow, at which it is generally valued.

4. THE DERBYSHIRE SYSTEM does not differ materially from that which obtains in Gloucestershire in making a thick (double Gloucester) cheese. It is usual to make but once a day, unless in very hot weather, when it may be doubtful if the milk can be got cool and kept sweet during the night, in which case cheese is made in the evening as well as morning. In general, however, the evening's milk is put in thin layers in the cheese-tub and other vessels to cool during the night, tin vessels of cold water being put to stand in it in order to subject it to as large a cooling surface as possible. In the morning, if much cream has risen, it is partly skimmed, and, if necessary, warmed up with some milk and added to the morning's milk, so as to bring the whole to about 80°. In the summer-time, however, the rennet has often to be added when the milk is naturally warmer than this. Enough fresh-made rennet is added to set the whole in an hour or less. After the curd has been broken with the common sieve curd-breaker, used gently for a sufficient time, a presser is used—a sort of heavy metallic sieve follower—which sinks gradually through the whey and ultimately lies upon the curd, enabling the baling out of the whey. After this has been for the most part taken out, this follower is forced hard down on the curd so as to squeeze and still further separate the whey from it. The curd may then be slightly salted, though this is not always done at that time. It is broken by hand into a vat and pressed; taken out and broken up again, re-vatted and again pressed; and this may be done more than once, as often, indeed, as seems to be required. It is at length finally vatted, in sizes of about 4 to the cwt.; its whole surface is made to

take in as much salt as it will hold by rubbing and pressing; this gets liquified by the exuding moisture and is absorbed. It is dry-clothed and changed in the press daily, and is in the press 4 or 5 days before being finally removed to the cheese-room, where it is turned at gradually-increasing intervals until ready for the market.

Somersetshire.—The following is the method adopted in a dairy near Frome, in which district the Cheddar system has generally supplanted the comparatively thin cheese of North Wilts. During the evening, from 4 to 6 o'clock, the milk brought in from the cows is strained into the cheese-tubs, and into other tin vessels to cool. The milk is occasionally stirred; and where tubs with false bottoms are used cold water is occasionally put under it during the summer months so as to more quickly cool it. Next morning the cream collected on the surface of the milk is skimmed, part of it being taken for butter; in some dairies, however, all the cream from the night's milk is put in the strainer through which the morning's milk is being poured into the cheese-tub. Some makers heat a portion of the *morning's* milk adding the night's cream to it, so that it may be better incorporated with the whole body of milk, and thus left in the cheese and not wasted in the whey. The varying practice in this respect is said to depend on the soil; some land allowing a larger quantity of cream to be taken from the milk, the cheese being still of sufficient fatness without it. But the practice varies also with the time of year.

All the night's milk being put in the cheese-tub, and the morning's milk strained into the same, the quantity kept back for heating is made hot enough to raise the whole to 80° or 86° Fahr., which is considered the proper heat for adding the rennet.

After this has been added the tub is covered over with a cloth, and in about one hour the curd is expected to have set firm enough for breaking up. It is now probably 8 o'clock, A.M., and the cheese-maker then commences to break up the curd. In the first place he cuts it in lines crossing one another with a long knife, and immediately afterwards it is completely broken up by the curd-breaker, by which the whole is lifted and stirred sufficiently but gently. The curd is now allowed to settle for a quarter of an hour, after which some of the whey is baled out. The process of scalding now commences. Those who have not an apparatus for scalding—the double-coated tin cheese-tub, allowing hot-water or steam to pass round its contents—heat the mass in the cheese-tub by whey heated in the boiler. By 8.45 A.M., or a little earlier, the first vessel of whey taken to the boiler has been heated to 120°, and is being gently poured into

the cheese-tub, the mass in the tub being carefully stirred the while, and for 15 minutes longer. It is now allowed to settle for another quarter of an hour, after which a portion of the whey is removed from the tub to the whey-tank, and a second lot of whey, also brought to 130°, is poured into the cheese-tub, the maker stirring and then allowing it to settle as before. Another portion of whey is then removed from the tub to the tank, and a third lot of whey, which has been heated to 140°, is now poured into the tub in the same way as the two previous lots. When this last lot of hot whey is in the tub the maker discontinues stirring, and the mass is allowed to settle for about 20 minutes. The curd and whey in the cheese-tub should at this time be about 100°. The whey is then removed from the tub to the tank, and the curd cut up and placed in the centre of the tub in such a way as to give the greatest facility for all the whey to run from it. When the curd has somewhat dried itself, say in about 45 minutes, it is broken by the hand into pieces about the size of an orange, put in comparatively thin vats, and removed to the press. It will now be about noon. The curd is allowed to remain in the press until about 3 P.M., when it is removed, ground down, and salted; about $2\frac{1}{2}$ lbs. salt to the cwt. being used. The ground curd is now allowed to remain in the cooler for about two hours, being turned occasionally during the time. At the expiration of the above time the curd is re-vatted in larger vats and removed to the press, where it remains till the following morning. The cheeses are then taken from the vats, turned over, clean cloths being put on them, re-vatted, and again removed to the presses. On the third morning the same process is gone through, and again on the fourth, with the exception now of covering the cheeses, instead of the ordinary turning cloth, with the thin tight cloths which are to remain on them when in the cheese-room. The cheeses are then taken from the press, bandaged, and removed to the cheese-room. The young cheeses should be turned over every day for the first week, afterwards not quite so frequently, and as they get older the less turning they will require.

The whey-tank referred to in this description is the vessel in which the whey is kept until the following day, when the cream is removed from it, and the whey is allowed to run into the cistern in the hogs'-house.

The quantity of butter made per cow in good Somersetshire dairies does not exceed half a pound weekly during the summer months. In the months of March and April, when cattle are feeding on hay and artificial foods, much more butter is taken from the milk. The milk is also naturally not so rich in curd as in the summer months, consequently a poorer but nice-

flavoured kind of cheese is then manufactured, which is generally made thin, about 4 or 5 to the cwt. This cheese is known by the name of hay-cheese, and sells at from 56*s*. to 66*s*. per cwt. In the height of the season the best Cheddar-cheese commands a price of 80*s*. or more per cwt. of 112 lbs.

As the milk diminishes in the autumn, the size of the cheese, generally 90 lbs. to 100 lbs. each, is maintained; and where hitherto two cheeses have been made, only one is made, the remainder of the curd being kept over till the following day—enough probably with to-morrow's curd to make two, with a smaller surplus of that day's curd unused. This added to the curd of the following day may make two cheeses without any remainder, and thus three days' milk makes five cheeses. In this way at length three cheeses are made in two days, four in three days, and so on. The cheese thus made hardly commands the full market value of the best cheese.

In the dairy thus described I have found the rare example of an annual record of experiment in which quantity of milk, quantity of curd, and quantity of butter, have all been ascertained in successive months. The figures for four out of seven past years are given on page 282. The quantity of butter named is the average per day for that week in which the cheese was made, not the daily average for the month that is named. The weights of milk and cheese are not daily averages for the month, but simply the quantity produced on the particular day of the experiment in each month. The number of cows varied from 57 to 63 in the several years. In 1868 the cows were receiving a little meal daily during April: the grass shrank during June, July, and August, and it was very hot and dry. In 1870 also the cows received meal during April. Foot-and-mouth disease broke out on July 10, and on July 23 the milk was reduced to 74 gallons daily. And again in 1874 the foot-and-mouth disease prevailed from April 23 to May 20, and land was dry and keep was short from this till August. I have taken the figures of only the alternate years. They may be usefully compared with those which we shall hereafter give from some of the Derbyshire cheese-factories.

Adding all the tabulated results together we have on an average 1 lb. of green cheese produced by 10 lbs. $8\frac{1}{4}$ ozs. of milk: the green cheese shrank only 6 per cent. before sale.

The cost of labour at this dairy is put by the tenant at 47*l*. a year. This, over a manufacture of 235 cwt., which must be considered a maximum produce for a stock of cows varying between 57 and 60, would correspond to 4*s*. a cwt. for labour only; but we presume that a strict valuation of all the services rendered in the dairy throughout the year would exceed

47*l*. One farther item of interest in the details which have been given me from this dairy may be mentioned: the lowest price of the past year was 64*s*., the highest 90*s*. per 120 lbs.—a range of 26*s*. per cwt.

Date.	1868.			1870.			1872.			1874.		
	Milk. Galls.	Curd. lbs.	Butter, lbs. per day.	Milk. Galls.	Curd. lbs.	Butter, lbs. per day.	Milk. Galls.	Curd. lbs.	Butter, lbs. per day.	Milk. Galls.	Curd. lbs.	Butter, lbs. per day
April	115	100	6	109	94	7	109	99	5	73	59	4
May	165	170	4	176	161	4½	162	153	6	62	59	6
June	158	152	3½	165	148	4½	..	..	..	133	124	4
July	117	111	3½	132	117	4	163	149	5	122	114	3¾
August	96	94	4	98	90	3	148	142	4½	118	116	2¼
September	118	124	5	88	90	3½	137	140	3	110	121	3
October	103	117	4	72	76	2½	90	103	2½	66	75	2
November	..	..	..	37	43	1	69	76	1½	52	58	2½
Average	124½	124	4¼	109½	102½	3¾	125½	123	4	92	91	3½

Weight of Cheese.			Weight of Cheese.		
Green.	When Sold.	Shrinkage.	Green.	When Sold.	Shrinkage.
lbs. 85	lbs. 80½	lbs. 4½	lbs. 85	lbs. 80½	lbs. 4½
75¼	71¼	4	75¼	71¼	4
24¾	23	1¾	90¼	86	4¼
32½	30¼	2¼	Loaf cheese } 17	15¼	1¾

*** No dates have been given when the above cheese was made or sold.

The Factory System of Making Cheese.

I have now to describe the factory system and its results in a sufficient number of examples, and over a sufficient period of time to make the experience to be reported of it trustworthy. The history, from the beginning, of the first established factories in Derbyshire has been already reported in vol. vii., s. s., p. 42-60, by Mr. Gilbert Murray, who has told the story of the first year's make—that of 1870—and of the public-spirited labours by which the system was, in the midst of some hardly avoidable blunders, and at some consequent expense to the guarantors, introduced. It was not until the end of the second year that the guarantors of

$6\frac{1}{2}d.$ per gallon to all contributors of milk were finally released from their responsibility; and it is only to the experience of the years 1872-3-4, that reference will now be made. That of 1872 is told in a pamphlet to which the signatures of the Honourable E. Coke, of Longford; Mr. J. G. Crompton, of Derby; and Messrs. J. Coleman and G. Murray were appended. Messrs. Coke and Crompton call attention to the greater uniformity and superior quality of factory-made cheese, to the economy of its manufacture, and to the influence which an increased value of produce from our dairy-farms must exert on the interest of both the landlord and the tenant. At the Longford Factory 211,338 gallons of milk from 458 cows (460 gallons a-piece) were made during 1872 into 91 tons 12 cwt. 3 qrs. 3 lbs. of green cheese, which, shrinking about 10 per cent., yielded 82 tons 7 cwt. 1 qr. and 25 lbs. of saleable cheese (4 cwt. nearly per cow), realising at 74*s.* 10*d.* per 120 lbs., 6166*l.* 14*s.* 8*d.* The whey (sold to the milk contributors at $\frac{1}{2}d.$ per gallon) and the whey-butter together made 475*l.* 12*s.* 4*d.* The cost of labour, in manager and assistants, was 215*l.* 18*s.* 3*d.*; of materials 103*l.* 14*s.* 5*d.*; and of marketing 118*l.* 3*s.* 10*d.* Besides this the rent of building, and of plant, and the cost of repairs amounted together to 65*l.* There was thus a balance of 6139*l.* 10*s.* 6*d.* for the contributors, which was divided among the milk suppliers at the rate of close on 7*d.* a gallon—the expense of labour and materials having amounted to 3*s.* $10\frac{1}{2}d.$ per cwt. of 120 lbs. of cheese—while the rent of building amounted to 9*d.*, and the cost attending the sale of the cheese was 1*s.* 5*d.* per cwt. It is added, that 10 dairymaids had been dispensed with by the suppliers of milk to the Longford Factory, who thus saved 400*l.* on the 300 cows belonging to those dairies at a cost to themselves (at 3*s.* $10\frac{1}{2}d.$ per cwt. on the cheese made from these cows) of 184*l.*

The Report of the Derby Factory for 1872 was also satisfactory. Here 51 tons 13 cwt. 2 qrs. and 15 lbs. of green cheese, shrinking $8\frac{1}{2}$ per cent. into the 47 tons 5 cwt. and 1 qr. of ripe, which was sold at 74*s.* 6*d.* per 120 lbs., was made from 274 cows; the labour and materials having cost 3*s.* $6\frac{3}{4}d.$ per cwt.; steam and water 1*s.* 5*d.* per cwt.; rates and taxes 1*s.* $2\frac{1}{2}d.$ per cwt.; repairs $5\frac{1}{2}d.$; and Secretary's salary $3\frac{3}{4}d.$ per cwt.—or 7*s.* $1\frac{1}{2}d.$ per cwt. in all. The statement shows that the sum of 3517*l.* 17*s.* 8*d.*, including 340*l.* 2*s.* 10*d.* for sale of whey and milk and butter, had been distributed among the milk suppliers at the rate of nearly $6\frac{3}{4}d.$ per imperial gallon, after paying the whole cost of working expenses and repairs.

This pamphlet is especially interesting from its detailed report of the quantities of milk received from the 39 different farmers who contributed to the two factories. It appears that

while the contributors varied as much as from two and three cows apiece to in one instance 50, there were on the whole from 814 cows 393,463 gallons of milk sent to Longford which received from March to November, and at Derby Factory which received only from April to October. This was at the rate of 483 gallons a-piece upon an average; the receipts from different farms varying from 624 gallons a-piece in a dairy of 3 cows to 343 a-piece in a dairy of 38 cows. This difference cannot be put down wholly to sort, food, or management, for we are expressly told that in some cases the foot-and-mouth disease had prevented milk being sent to the factory; but it is plain from the large number of examples in which 450 gallons and upwards is the return, that this is under one style of management, perhaps from one class of soil, the ordinary annual produce of healthy cows, while in other large dairies more than 500 gallons appears to have been the common experience.

The balance sheets of Longford, and of the Windley Hall Factories, have been sent to me for 1873. In the former case the plant was purchased by an entrance fee of 10*s.* per cow on 517 cows, and thereafter the account stands as follows:—221,148 gallons of milk yielded 93 tons 18 cwt. 3 qrs. 22 lbs. (120 to the cwt.) of green cheese, which shrank 7 ton 13 cwt. or about $8\frac{1}{2}$ per cent., and was sold (86 tons 5 cwt. 3 qrs. 27 lbs.) at 82*s.* 4*d.* per cwt. for 7106*l.* 2*s.* 7*d.* Besides this, 2898 lbs. of butter realised 167*l.* 14*s.* 5*d.*; the whey sold for 326*l* 15*s.* 1*d.*; and there were other small receipts amounting to 13*l.* 6*s.* 3*d.*, making 7633*l.* 18*s.* in all; out of which, after paying the whole cost of working expenses—materials, labour, fuel, commission, and repairs—609*l.* 7*s.*, equal to 7*s.* $0\frac{3}{4}$*d.* per cwt., the contributors received rather more than $7\frac{1}{2}$*d.* per gallon. The following is an enumeration of the costs:—

	s.	d.		£	s.	d.
Labour	2	$7\frac{1}{2}$	per cwt. of the cheese	227	18	0
Materials	0	$8\frac{3}{4}$	,, ,, ...	64	8	8
Fuel	0	6	,, ,, ...	44	7	6
Soda, brushes, &c.	0	$0\frac{3}{4}$	,, ,, ...	6	11	5
Rent and rates ..	0	8	,, ,, ...	57	11	1
Repairs	0	$2\frac{3}{4}$	,, ,, ...	20	2	2
Total	4	$9\frac{3}{4}$	.. ..	£420	18	10
The other charges included Secretary's salary and commission for sale, &c.				78	10	0
Manager's bonus of 10 per cent. on value realised for milk over $6\frac{1}{2}$*d.* per gallon				98	0	0
Sundries				11	18	2
Total = 7*s.* $0\frac{3}{4}$*d.* per cwt. of the cheese ..				£609	7	3

The Windley Hall Factory on the estate of Mr. J. G. Crompton was started on May 9th, and closed for the year on November 14th, 1873. During that time 86,974 gallons of milk were received from contributors, and yielded 34 tons 1 qr. and 20 lbs. of saleable cheese which was sold at 83*s.* 7½*d.* per cwt. (120 lbs.), for 2851*l.* 18*s.* 9*d.*: butter and whey realised 142*l.* 2*s.* in addition; and the 2998*l.* 5*s.* 6*d.*, thus received, yielded no less than 7¾*d.* per gallon to the contributors, besides paying 168*l.* 7*s.* 9*d.* for labour, materials, fuel, rent, and sundries, and leaving a balance of 21*l.* 7*s.* undistributed. In this case the labour had cost 2*s.* 5*d.* per cwt.; materials 10*d.*; fuel 5*d.*; rent 8¾*d.*; sundry payments 3¾*d*; and no charge appears for marketing.

We come now to the year 1874, and before stating the results of my inquiries on the manufacture of the past year at no fewer than six factories in Derbyshire, I will relate the history of one of the first of these factories, which has been established simply by the labour of the contributing tenant-farmers who had resolved upon having one.

The following account of the Holms Cheese Factory has been given to me by Mr. J. P. Sheldon, of Sheen, near Ashbourne, as the first which had been established by tenant-farmers exclusively—that is, without the aid of the leading landowners of the district. It has, of course, been started by the activity and energy of only a few who at length succeeded in overcoming the indifference or opposition of others; but except in so far as it may have been prompted by the example set on the estates of the Hon. E. Coke and Mr. J. G. Crompton, to whom the credit of establishing the dairy-factory system in Derbyshire is due, the Holms Factory may be said to have owed nothing to external influence or assistance.

Mr. J. P. Sheldon had, in 1871, made a trip to the United States, to inspect the cheese-factory system there, in order that he might urge with the authority of an eye-witness the feasibility of the scheme. His impressions on this point were given at some length in the 'Milk Journal' of January, 1872. He now says:—

"Whilst the Holms Factory was being built, the site on which it stands was designated 'Fools' Corner;' but this name, and the prejudice in which it had its birth, have both died away, except in a few incurably 'long-horned' instances, and, generally speaking, the factory system of cheese-making is now looked upon with cordial approval among us.

"Some farmers were under the necessity of, at all events, simulating opposition to the scheme, because wives would not relinquish the butter-money. This perquisite they could not forego. Also pigs were an element of discord. 'How about losing my pig-manure?' said the farmer. 'On what must I rear my calves and feed my pigs if you take all the milk away?' said the farmer's

wife. It is odd that we never hear such questions raised in connection with sending milk to cities. These and all other objections, refuted time after time, at length disappeared, and a sufficient number of farmers undertook to put up the building and furnish it with plant, taking, in fact, all the cost and risk upon themselves. Of the original six, however, two withdrew, and the work was begun and completed by the remaining four.

"Mr. Shirley, of Rewlach, put up the building at his own cost, on his own land, and the situation is a good one. Three others have done the remainder, and, with Mr. Shirley, form the Managing Committee. The entire cost of the concern has been 360*l.* In its present form it has capacity for the milk of 300 cows, though for the present we have had to content ourselves with 230. By putting in an additional milk-vat we shall be able to work up the milk of 450 cows. In order to supplement the storage-room we intend to put in a quantity of additional shelving, and the lower curing-room, where the green cheese is first placed, is to be furnished with adequate 'turning-shelves.' If properly constructed these turners are most important economisers of time and labour, while they offer no hindrance to a proper examination of the cheese at the time of turning it. The best I have seen are in tiers of three shelves, the ends of which are secured in a strong piece of timber, which has an axle in the centre on which it readily turns.

"Our factory fairly commenced work on May 15, 1874. From that date till the end of the season, in November, we received 817,149 lbs. of milk, from which we have made 2419 cheeses, which in their green state, after being taken out of press, weighed 81,288 lbs. In the first eight weeks it took an average of 10 lbs. $9\frac{3}{4}$ ozs. of milk to make one pound of green cheese. I took the average of five days in the early part of June, and found then that 10 lbs. 11 ozs. of milk went to one pound of green cheese. It is therefore evident that, since that time, the proportion of casein, &c., in milk had increased to the extent of reducing the whole average for the eight weeks $1\frac{1}{4}$ oz. below that of the five days in June. The milk continued to yield a greater proportion of curd week by week during the remainder of the season, until at the close it appeared that the green cheese for the whole season corresponded, as nearly as possible, to one-tenth the weight of the milk from which it was made. The actual average is 1 lb. of cheese to 10 lbs. 0·84 oz., or nearly 4 oz. under the gallon, of milk—a gallon weighing 10 lbs. 4 oz.

"The labour at the factory this season has cost us about 120*l.*, and we have been enabled, by means of it, to dispense with the services of eight dairymaids, whose board and wages, in the aggregate, could not well be estimated at a less sum than 300*l.* Nor is this a hardship on dairymaids, for they are, as a class, rapidly disappearing. We also secure a considerable saving in material and incidental expenses. I consider that, with the exceptions of wages, salt, and rennet skins, our incidental expenses at the factory are no higher than they would be in a 40-cow dairy at home. We dispense with one dairymaid at each considerable farm; this, however, will entail extra milking on the remainder of the staff, for generally the dairymaid milks.

"We have already sold 22 tons of cheese at an average of 4*l.* 0*s.* $9\frac{1}{4}$*d.* per cwt. This is a price which is considerably above what we should have made of home-made cheese. We save considerably in being able to sell the factory-made cheese at six weeks old, instead of having to keep it on hand for periods varying from three to nine months. We also have an important gain in the production of more cheese from a given quantity of milk than is done in farm-houses. We take no butter from the milk, nor have we gathered any from the whey during the greater part of the season. Another season we intend gathering whey-butter.

"We allow our contributors to take the sour whey home in the same cans in which they have brought the milk to the factory, and with care in scalding the

cans at home, this plan, so far as we can see, has no ill effect on the cheese. Still it behoves the manager to be vigilant in detecting sour or impure milk of any description; and two members of the Committee should occasionally attend at the factory, when the milk is being received, to thoroughly examine all the milk-cans for signs of uncleanliness.

"It is to be hoped that the Legislature will add a clause, having express reference to milk supplied to cheese and butter factories, to the existing 'Adulteration Act.'*

"Generally speaking landlords ought to build cheese-factories for their tenantry. The milk suppliers, on their part, should supply the plant, the cost of which should be distributed amongst them, *pro ratâ*, on the number of cows each one milks. If this money be judiciously laid out, it ought, in no case, to exceed 15*s*. per cow at the outset. Repairs of course are paid for out of the working expenses. It would, however, simplify matters considerably if the landlord were to supply the heavy plant, receiving an equitable interest thereon, which would cover its renewal. If convenient, with reference to water and roads, cheese-factories should always be erected in dry and airy situations. The odours arising from damp situations and from stagnant pools of water are inimical to the production of uniformly good cheese, as milk is peculiarly susceptible to impure odours and liable to absorb them. I consider they also injuriously affect the ripening of the cheese. The water-supply to a factory should be cold enough to reduce the evening's milk to 60° Fahr., at which temperature it will remain sweet enough. If the milk were properly aërated as well it would keep sweet at 68°. The supply of water should be constant, as it has to run under the vats all night. A 2-in. pipe will bring ample water for a factory of 500 or 600 cows.

"It is our intention to build piggeries near, but not too near, the factory. We consider that we shall make some profit from feeding pigs on the spot, though pig-feeding, as a rule, does not pay very well at farmhouses. We may buy the pigs at a cheaper rate in large quantities, and we may buy our feeding-stuffs at wholesale prices. The food should be steamed and given to the pigs before it is cold. The piggeries must be arranged so as to reduce the labour of attending on them.

"It is general in America to have piggeries contiguous to the cheese-factories, and they consider a cheese-factory incomplete without its piggeries. We also consider it a nuisance to have to take the whey home again."

The following is the system of management at the Holms Factory:—The evening's supply of milk is received into, and pretty equally divided amongst, the large milk-vats, which are capable of holding 500 gallons each, being 14 feet long, by 48 inches wide, and 20 inches deep. These vats are made of the best tin, and are supported by a stout framing of deal or pine, between which and the tin is a space under the bottom and along the sides. During the night a stream of cold water is kept constantly running under the vats, in at one end and out at the other, filling the space between the tin and the wood, and thus cooling the milk which the vats contain. This stream, as it issues from the lower end of the vats, is conducted by indiarubber tubing to a small water-wheel sunk in the floor.

* The text of the State of New York Act relating to diluted milk is given in a foot-note to p. 199, vol. vi., 2nd Series.

Gradually filling the floats of this wheel, it at length causes half a revolution, which, by crank and lever overhead, actuates floating wooden rakes, sinking 2 or 3 inches in the milk, which are thus driven a foot or two to and fro upon the surface of the milk in the vat, at intervals of a few seconds all night long.

The evening's milk is in this way cooled before morning, even to 60° or 65°; and a supply of cool water for this purpose, either from a spring or pumped from a tolerably deep well, is one of the most important requirements in order to the success of a factory. The object in using the agitating contrivance * is to prevent any cream rising on the milk during the night; but it also performs the further important office of doing something towards aërating and deodorising the milk—an office which might most beneficially, during the hot weather, be performed on the milk before it leaves the farmstead: thus enabling it in some measure to get rid of the animal heat and odour which tend to the too early and rapid decomposition of the milk in hot weather, and are distinctly inimical to the production of the finest-flavoured cheese. This aëration should, indeed, take place as soon as the milk is drawn from the cow, in which case it may be safely taken any reasonable distance, and jolted and shaken over any sort of rough and uneven roads, even though contained in closely-lidded cans, without fear of its being injured during the transit to the factory. Milk obtained from heated cows that have been tormented by the attacks of insects during a hot summer's day is obviously already in a state of heat and ferment closely bordering on actual decay. Such milk should be well aërated before being despatched. It is not so necessary to use these precautions with the morning's milk, which, on arriving at the dairy, is at once mixed with the evening's, which has been cooled and agitated all night in the milk-vats in the factory. When sufficient fresh milk has run into that vat which is farthest away from the weighing-machine, the pipe conducting the milk from the tin on the weighing-machine, where it is received and weighed as it arrives morning and evening from the several contributors, is shortened, to adapt it to the next vat, and so on to the last. Steam is now turned under Vat No. 1, and the whole mass of milk in it raised to a temperature of 80° Fahr., after which the rennet is mixed with it. The heating of the milk at this stage may with advantage be made to depend a little on the state of the weather and the time of the year. In hot weather it should not exceed 80°, and in cold it may be as high as 82°. The quantity of rennet to be mixed with the milk

* Another form of this apparatus is figured in Mr. Willard's paper on 'Milk-condensing Factories,' on page 151, vol. viii., 2nd Series.

will also be varied according to the season of the year: in the autumn more of it is required to coagulate the milk than in spring or summer, the milk in the autumn being more heavily charged with solids. The exact quantity of rennet to be added will depend on its quality and purity. But if it be as good as it ought to be, half a pint to 100 gallons of milk is sufficient. The test of the strength of the rennet is that the milk with which it is mixed shall have perceptibly thickened in fifteen minutes, and that coagulation shall be perfected in an hour, the vats meanwhile being covered to preserve uniformity of temperature.

When the curd will break cleanly over the finger, coagulation is perfected, and now the curd-knife—a many-bladed cutter, the edges being about half an inch apart—is passed slowly lengthwise through the mass, from one end of the vat to the other, and back again, until all is cut. The edges of this knife are sharp and fine, so as not to bruise the tender curd. The curd is now allowed to rest a few minutes, until the whey begins to float over it, when the curd-knife is again passed through the mass, crossing the direction taken before, and leaving the curd in pillars of half an inch square. In this stage the whey rapidly escapes, while the curd gradually subsides towards the bottom of the vat. After remaining in this condition for a short time the curd is very slowly and tenderly turned over by the hands, after which the curd-knife is freely, though very carefully used, cutting the curd into pieces about the size of hazel-nuts. A little steam is then turned into the space between the tin and the woodwork, which was occupied by cold water during the night, soon after which the curd will bear turning about a little faster. During this time the whey continues to rapidly exude, and the pieces of curd to shrink correspondingly in bulk. Up to this stage the curd demands the most delicate handling, as it is very tender, in order that it may not be bruised, and that none of its liquid fats may pass off into the whey. More steam is now turned on, and the curd is stirred much quicker, in order to prevent it being scorched at the bottom of the vat. As the whey has by this time almost completely left the curd, the latter has lost its tenderness, and becomes comparatively hard and tough. A curd-rake may now be vigorously used to keep the curd-particles continually in motion. When the temperature of the mass has reached 90° Fahr., the steam is turned off, and the curd kept stirring for a time until the vat-bottom has cooled, so as not to injure the curd. It is now left at rest for some ten minutes. At the end of this interval the steam may be again turned on at full pressure, and it is imperative that the curd now be kept in constant motion. The manager will now, as before, use his thermometer occasionally until it denotes 100°, when the steam

is turned finally off, and the curd, as before, kept stirring a few minutes beyond this, until the vat-bottom has cooled down. The entire mass is now allowed to rest for an indefinite time, during which the manager is careful to watch the development of the souring process. An experience of a few months will enable any attentive and intelligent person to determine when this acidity has attained the proper degree. He may do this by taste or smell; but a surer plan is to take a piece of curd in the hand, squeeze the whey well out of it, and touch hot (not red-hot) iron with it. If sufficiently acid the curd will stick to the hot iron, and draw out in fine threads an inch or more long. The whey is now all run off by a syphon, and the curd is gathered to either side of the vat, so that the whey can run down the middle. There is yet some little whey left in the curd, and this continues to drain slowly away as the curd lies packed at the bottom of the vat. Presently the curd, which now adheres together in a mass, is cut into pieces, and turned over time after time until little or no whey runs from it. It is then ground in a curd-mill, and when ground, has salt mixed with it, at the rate of 2 lbs. of salt per 1000 lbs. of the milk from which it has been made; in autumn a little more salt is used, or 2½ lbs. of salt per 1000 lbs. of milk. The curd being ground to about the size of raisins, and salted, is now vatted and put under the lever-presses for an hour, during which time the little whey still in it is pressed out. It is then taken out of press, bandaged, and put in again. Here it remains, with a good pressure upon it, until morning, when it is finally taken out of press, conveyed to the lower curing-room and weighed, has some tissue-paper ironed on to the flat sides of it, and is put on the cheese-shelves. Here it is turned daily for a few days until it goes to the upper curing-room, where it will be turned every other day. This cheese is ready for sale in six weeks to two months after it is made. But cheese made in autumn takes a longer time to ripen. The tissue-paper is ironed on the cheese with the view of preventing cracking.

"At the present time," says Mr. Sheldon, "there is a dearth of factory managers, and the committees of intended cheese-factories ought to send young men to our Derbyshire factories to be trained, so as to have a manager of their own at hand."

I add the Bye-Laws of the Holms Dairy, by which the contributors are bound:—

"1. Persons sending milk to the above dairy shall be required to send, *twic* each day, the *pure milk* from the whole of their dairy cows (excepting suc milk as shall be required by them for their family consumption) during th making season, the commencement and termination of which shall be deter mined by the Managing Committee.

"2. No person shall send, and the Manager of the Dairy shall have powe

to refuse, any milk that is of an inferior quality, skimmed, sour, dirty, or otherwise impure; nor shall any person keep back that portion of the milk known as 'afterings' or 'strippings.'

"3. Milk from a *newly-calved cow* shall not be sent to the dairy until the cow has been calved *four days.*

"4. Milk will be received at the dairy from half-past five to half-past seven o'clock in the morning, and from five to seven in the evening.

"5. The cans used for carrying milk to the dairy, and other utensils connected therewith, must be kept thoroughly sweet and clean.

"6. A correct account of all milk received at the dairy, with the number and weight of cheese made therefrom, shall be kept by the manager at the dairy; which account shall be open at all times to the inspection of any milk contributor."

The mode of dealing with the milk in the large vats of the factory can be varied to suit the practice of any county. The ordinary Derbyshire cheese is made at the Holms and other factories in Derbyshire. The Cheddar system is adopted at Mickleover, which is in the hands of Mr. Henry Harding, a son of Mr. and Mrs. Harding, of Marksbury, who finds that the longer heating, the minuter subdivision of the curd, and the prolonged exposure of the curd after being ground in the curd-mill, which are characteristics of that method, are as perfectly well adapted to the scale of operations of a factory as they are to the scale of a smaller dairy. Mr. Livesey and Mr. Etches, who inspected the several Derbyshire factories last summer, in order to award the prizes offered by Mr. J. G. Crompton for good management and its results, gave the first prize to Mickleover, notwithstanding that it was not so well equipped as some of the other factories. Mr. Harding's cheese has made the highest prices of the season, the later makes having fetched as high a price as 90*s.* per 120 lbs. Mr. Harding is especially anxious on the subject of the rennet he employs. Old Irish vells are preferred, and they are soaked in brine—about six vells to every 2 gallons—one lemon sliced, and an ounce of nitre being added to it; and of rennet thus made one-third of a pint is enough for 100 gallons of milk at 80° of temperature.

The following is Mr. Harding's account of the process carried out under his direction at Mickleover, so far, especially, as the character of the rennet is concerned:—

"The process of cheese-making followed at this factory is the same as has been described at Mr. Harding's, of Somersetshire, in all its details; but having a larger quantity of milk to deal with, we use the 'agitator,' which, as I believe, by preventing the cream from rising, frees the milk from any obnoxious gases, which would otherwise be sealed down by the layer of the cream, and thus prejudicially affect the milk. In illustration of this, I may mention that the 'agitator-wheel,' being out of repair, I could not work it during two nights; the cream rose, and on being stirred in the morning a peculiar odour was clearly perceptible, the curd retaining it throughout the day, and it was easily detected in the flavour of the cheese at ten weeks old. Good rennet is

one of the most important items in cheese-making, its quality being the foundation of a good or bad cheese, which means a difference of 15*s.* or 20*s.* per cwt. in the market value.

"This matter is of such importance that the greatest care is required in the selection of the vells. The best are supplied from Ireland, where many calves are killed on the day of their birth, or within a day or two. The vells thus obtained are the smallest; and, unimpaired by age, they retain all their coagulating properties.

"When the Irish feed their calves (they kill them at about ten weeks of age) the vell is *large* and *fat*, and the digestive organs having been called into use are, as I believe, impaired and weakened for coagulating purposes, henee the cause of two prices for 'Irish vells' being quoted in our markets. A large supply of this class of 'skins' comes from Germany also, and the German skins are much used in this and neighbouring counties.

"A vast quantity of cheese is made 'out of flavour,' and this can easily be traced to bad rennet. It is remarkable that in the West of England, where only the 'best Irish vells' are used, the average quality of cheese is higher than where the second-class skins are used. The demand for this lower class of skins is kept up by those cheese-makers who work by the 'rule of thumb;' and when their cheese is 'out of flavour,' or 'loose in texture,' the blame is laid on some portion of the land. 'When the cows are feeding in *that* pasture,' it is said, 'the cheese will always heave.' This hasty conclusion ends their investigation; they never think of looking for the cause elsewhere, much less in the rennet-jar, where the incipient seeds of bad flavour are sure to be found. These large, or 'fed vells,' will frequently emit a 'tallow smell' when kept a few weeks after the steep is made; probably caused by the decomposition of the 'milky matter' contained in the vells. At the commencement of this seaso the writer bought a few dozen of these inferior skins, and made a 'steep from the recipe given below, and all the cheeses made from them were defective in flavour, and 'characterless.' Knowing that cheese is made *in th dairy*, and that change of pasture has but little effect on the quality an flavour of it, he came to the conclusion that the cause of imperfection wa more under his immediate control. He soon found the cause in the rennet jar. The steep, on being stirred up, had the appearance of a quantity c tallow being mixed with it, caused, no doubt, by the decomposition abov alluded to. He had a few days previous ordered a supply of the 'best Iris vells' from Mr. Titley, Bath, at double the cost of the inferior, and as soon a he could use the 'steep' made from them by the same recipe, the quality c the cheese improved 4*s.* per cwt., as the cheese made on the 19th May, fro the bad rennet, sold at 80*s.*, and that made on the following day realised 84*s*

The following is a recipe for making a perfect rennet:—Mix a brine strong salt and water, sufficient to float an egg *well*; boil half-an-hour; let stand till cold; to two gallons add six vells, one lemon, sliced, and one oun of saltpetre. It will be fit to use in a month, and will keep any length of tim

They have now erected a large and commodious factory ne Mickleover, at which there is accommodation for the milk 600 or 800 cows. A floor of 60 feet by 28 feet 6 inches, provided for the whole working arrangements. There is roo for five vats of the usual size. On one side at the end is tl engine-room, 12 feet by 20 feet, and the floor over the who is used as a cheese-room; the whole being warmed by stove and the roof, boarded under slate, with sawdust between t two, is of a sufficiently non-conducting material to insure

tolerably uniform temperature. The accommodation includes the usual arrangements for receiving and weighing the milk as it is brought up morning and evening, vats, and water-wheel for working the agitators, store-room for the materials employed, cisterns for the whey as it is drawn from the cheese-vats—and thence, after being skimmed, to the tank, from which it is pumped to the customers, a butter dairy, a well and pump and tank of sufficient capacity for night use, ample flooring for cheese, and a house for the manager. The whole, I understand will be erected and equipped for the sum of 1200*l.*, which is about 30*s.* per cow on the possible number whose milk could be received at it. This is being erected by Mr. C. E. Newton, the owner of many of the farms from which milk will be received; and a rent will be charged.

This seems to be the way in which the system can best be introduced. Certainly the landowner is interested in the adoption of a manufacture by which the money value of the annual produce of his estate is very materially increased; and he may therefore be expected to erect the buildings and fixtures necessary for it, charging a sufficient rent, leaving the contributors to provide all the utensils and portable "plant."

The respective shares of landowner and tenant, in providing the means for starting the factory system, were the subject of a discussion at Derby in December last, of which the following seemed to be the generally accepted conclusion. I quote Mr. Gilbert Murray's letter to the 'Derby Mercury':—

"The proprietor of the land to erect at his own cost the whole of the necessary buildings, and obtain a sufficient supply of water, either conveyed through pipes from the nearest source, or from a well sunk on the premises, for which a rent-charge of 5 per cent. per annum on the amount so expended shall be payable to the proprietor, the tenants undertaking to repair. This rent, whatever its amount, should be charged *pro ratâ* on the number of cows, and included in the working expenses. The term 'fixed plant,' which should likewise be erected at the cost of the proprietor, would include the steam-engine and boiler, with all shafting, pulleys, belts, and other connections; desk, and other office fixtures; agitator-wheel, weighing-machines, lift, tramway and waggon, stoves and pipes, cheese-shelves, steam and water-pipes—the tenants or milk suppliers covenanting to repair and pay at the rate of 7 per cent. a year interest on the first cost, each individual milk contributor having no further interest in the fixed plant beyond the time he continues a member of the Association. Hence this payment should likewise be included in the working expenses.

"The 'portable plant' will include the milk-vats, curd-knives, presses, curd-mill, hoops, churn, tin vessels, pails, and buckets. Those would be furnished by the contributors at a cost of from 5*s.* to 10*s.* per cow, which every farmer would be called upon to pay on entry, or at least at the expiration of the first working year. The probable duration of the portable plant is ten years; this will entail a cost of 10 per cent. per annum in order to replace it in that time, or an annual charge of 6*d.* to 1*s.* per cow. This is clearly a capital account, and should be treated as such, and kept entirely distinct from the

working expenses. The yearly 10 per cent. should form the nucleus of a separate fund, from which the portable plant should be maintained in an efficient state of repair; and in the case of a milk supplier withdrawing from the factory under any circumstances his entrance fee would always remain intact, and be handed over to him on leaving the Association. This appears to me the most equitable means of placing the undertaking on a business footing."

Before concluding with such statistics of last year's experience at these factories as I have been able to obtain, I may mention that at the factory in Derby, which I saw last summer, 18 farms were contributing milk, which, however, was at that time being despatched to consumers in London. At Mickleover 12 contributors were sending about 570 gallons daily from 250 cows, 60 or 70 lbs. of butter being made weekly: the Cheddar system of cheese-making was being adopted. At Longford the milk of 527 cows from 32 contributors was being dealt with, and the manager and two young assistants were said to be displacing more than a dozen dairymaids, who would have been employed at the several farms on the milk sent to the factory, during nine months of the year. At the Holms factory milk from 18 contributors was being dealt with on the Derbyshire plan already described. At the Windley Hall factory milk from 18 contributors, and at Alstonfield milk from 17 contributors—about 460 gallons daily from 230 cows at the time of my visit—was being manufactured. In addition to these I visited Tattenhall, in Cheshire, where the milk from two large farms was being dealt with on the factory system, the advantages of which Mr. Jackson's father was the earliest to perceive and advocate. The necessity for Sunday work is here evaded by delaying the Saturday's manufacture till the evening, and dealing with three meals of milk instead of two on Monday morning. At Lichfield, too, I have seen a factory, now three years in operation, which commenced with 15 contributors, finishing off, however, last year with only 10, some of whom send their milk a distance of four miles. The milk of only 150 cows was here sent, and it had been a disastrous year in respect of the foot-and-mouth disease. The manager receives 1*l.* a week, together with 10*s.*, 15*s.*, and 20*s.* bonus per ton on the cheese, according as it realises 70*s.*, 75*s.*, or 80*s.* per cwt. He had made only 16 tons of cheese. At Nethercote, by Bourton-on-the-Water, I saw a factory at which Mr. Wilkins makes cheese, buying milk for the purpose in addition to that of his own 25 cows; and I was astonished to hear that he had been receiving milk from no fewer than 167 cows, for which only 6*d.* a gallon was paid. At Rooksbridge, near Weston-super-Mare, two farmers have built a factory and extensive piggeries, ten others sending their milk, and leaving the whey as their payment for the labour, fuel, and materials

employed in the manufacture. The Cheddar system is adopted through the summer: thin cheese, on the Derbyshire plan, being made during the earlier months. About 10 tons per month had been made in the dry months of July, August, and September of last year, 13 and 14 tons having been made in May and June from the same cows, about 380 in number. A manager with two assistants, at 20*s.* and 16*s.* a week respectively, were making the cheese. The whey ran off to tanks, whence it was pumped to the large piggeries, which were too near the factory to be advisable or even agreeable.

In addition to these, I hear of a factory at Sutton-on-the-Hill for 500 cows; one at Hartington, in the Peak district, for 500 cows; one at Grange Hill, also in the Peak district, for 400 cows; one at Ellaston, near Ashbourne, for 500 cows; one at Kedleston, on Lord Scarsdale's property, for 500 cows; one at West Hallam, on the property of W. Drury Lowe, Esq., for 300 cows: all these in Derbyshire. One at Balderton, and another at Alford, on the Duke of Westminster's estate in Cheshire, are being erected for 800 cows each; and there is a small one at Worle, in Somersetshire, and one for 300 cows at Beedy, near Melton, Leicestershire. It is plain, therefore, that the system is extending; and this is justified by such facts of the year 1874 as have been allowed to appear.

In order that I might obtain the financial results for 1874 of the cheese-factories of Derbyshire, I addressed a circular to each asking for the weight of milk received and of green cheese made from it month by month in each—the quantity of cheese sold from each at the date of my inquiry—the lowest, highest, and average prices which had been realised per cwt.—the quantity of cheese then unsold—the cost of labour, fuel, salt, rennet, annatto, bandages, and any other materials during the year—the rent of building and of plant—the number of milk-suppliers, and the number of their cows. It is only in three instances that I have received anything like the full details which are wanted for a complete report. Now that these factories are under co-operative management, bent not, as till lately such factories were, on convincing neighbours that the system was a success, but simply on realising the largest possible profit for their "patrons" and contributors, there is no such motive for publication as formerly existed. And accordingly I have been told, in several instances, in answer to my application, that my questions cannot in fairness be asked of any private association for the purpose of publication. I am, however, able to state pretty fully the facts regarding one or two of these associations. For instance, of the Holms cheese-factory, of which a full report has been

already given, I hear that they have had throughout the past season the milk of 230 cows, the property of 17 contributors: 79,722 gallons of milk have been received, and 81,288 lbs. (677 cwt. 48 qrs.) of green cheese have been made; 614 cwt. 3 qrs. 27½ lbs. have been sold at an average price of 80*s.* 9*d.* per cwt., indicating a shrinkage of 9 per cent. The cost of labour had been 120*l.*; of fuel, 15*l.* 7*s.* 7*d.*; of salt, rennet, annatto, and bandages, 28*l.* 9*s.*; of rent and interest on plant, 18*l.* 16*s.* The balance for distribution, supposing there is no charge for marketing, would be close on 6½*d.* per gallon for cheese alone, exclusive of whey and butter.

At the Windley Hall Factory, where a considerable quantity of the milk received had been sent to London, the cost of labour —manager, 75*l.*, assistant, 29*l.* 14*s.*, and extra-assistant, 11*l.* 13*s.*, —amounted to 116*l.* 7*s.*, or 2*s.* per cwt., for the 58 tons 17 cwt. 3 qrs. and 3 lbs. of green cheese which had been made. The cost of materials—coal, 15*l.* 16*s.* 4*d.*, coke, 2*l.* 19*s.* 2*d.*, bandages and cloths, 4*l.* 14*s.* 1*d.*, salt, 5*l.* 8*s.*, rennet, 22*l.* 17*s.* 8*d.*, and annatto, 1*l.* 12*s.*—amounted to 53*l.* 7*s.* 3*d.*, or 11*d.* per cwt. of the cheese. The petty expenses, amounting to 7*l.* 9*s.* 5*d.*, reached 1½*d.* per cwt.; the account-keeping—10*l.*—came to about 2*d.*, and the rent of the building and plant—40*l.*—to 8*d.* per cwt. The cost upon the whole thus reached 3*s.* 10*d.* per cwt. of the green cheese manufactured, or, assuming a shrinkage of 10 per cent., to rather more than 4*s.* 3*d.* per cwt. over the sale. Deducting the charges for rent and accountant, it would amount to 4*s.* exactly. And let it be remembered that this on a dairy of 30, 40, 50, or 60 cows, yielding 4 cwt. of cheese apiece, would amount to an expenditure of only 24*l.*, 32*l.*, 40*l.*, or 48*l.* respectively for the sum of the items of labour, fuel, and materials employed in cheese-making. Of course the milk has to be carried under this system, and the milking of the cows and the scalding of the vessels have still to be done and paid for under any system; but it is not to be doubted that there is here an immense saving of labour and cost. And this, it is plain, is not the only nor the principal advantage: the value of the produce is the leading consideration after all, and when the prices realised at a factory come to be considered, it is plain that, dealing as it does with the milk of so many dairies, they must be compared, not with the maximum, but with the average experience. There are no doubt a few who, on hearing that the whole cheese of Windley Hall dairy made 83*s.* 7½*d.* per cwt. for the year 1873, and 81*s.* per cwt. for 1874, up to the date of our information, will know that they made as much, or even more; but the great majority must confess that they would have gained considerably, apart altogether from the diminished cost of labour, had their milk

been sent for manufacture to the manager and machinery of the neighbouring factory, both selected respectively for their skill and fitness.

At Mickleover 107,852 gallons of milk, received last year from 250 cows in April and afterwards, till November, produced 102,882 lbs. of green cheese. And if we here again assume a shrinkage of 10 per cent., there must have been a sale of upwards of 38 tons. The cheese made at this factory up till the date of my inquiry had made an average price of 85*s.* per cwt. of 120 lbs. The labour in this case cost 140*l.*, fuel 18*l.*, materials 12*l.*—170*l.* in all, or rather more than 4*s.* 4*d.* per cwt. The labour employed and paid for here could have dealt with double the quantity of milk; the materials employed were, of course, in proportion to the milk on which they were employed. Another year will see the larger Mickleover factory at work, when the excessive charge per cwt. for labour will be reduced. The price obtained here, indicates the superior quality of the manufacture, to which reference has been already made.

At Longford 246,553 gallons of milk had been made into 250,133 lbs. of green cheese; 84½ tons had been sold, at an average price of 82*s.* 3¾*d.* per 120 lbs. Of the costs during the past year in this case I have no information.

The particulars given, imperfect though they are, will, I believe, convince the majority of cheese-makers who know the maximum quotations of the cheese-market to have been always far above their experience—especially any who may have been in the habit of calculating the costs incurred in their dairies against the quantity of their manufacture—that both excellence and economy of manufacture are, as might have been expected, especially achieved in factories where large quantities of the raw material are dealt with by the greater skill and the best machinery that can be procured or hired.

The number, however, of those who have been in the habit of accurate and quantitative observation in English dairies is, unfortunately, very small. It is one advantage of the factory system that it at once awakens all who contribute to it to the questions of quality and quantity. The weight of the milk received from each contributor is recorded daily, the quantity of green cheese made is every day ascertained, the shrinkage before sale is known, and, under co-operative management, every one is on the look-out for deficient results of any kind. The "patrons" of a factory know perfectly how much milk it takes to make a pound of cheese; but, though they had been making cheese for years and generations previously, not one in a hundred of them knew for certain anything about it before.

I give here such figures as I have been able to ascertain from some of the factories which I have visited in Derbyshire and elsewhere. It is impossible to doubt that the publication of such figures, and the discussion of them, not only in farmers' clubs but in farm-houses at the fireside, will set people inquiring as to the varying value of dairy breeds, as to the effect of food on the milk produced, as to the influence of soil and climate, and the economical effect of various dairy processes—with very serviceable and useful results.

Month.	Windley, 1874.				Longford, 1873.				Longford, 1874.			
	Milk.	Green Cheese.	Milk to 1 lb. of Cheese.		Milk.	Green Cheese.	Milk to 1 lb. of Cheese.		Milk.	Green Cheese.	Milk to 1 lb. of Cheese.	
	lbs.	lbs.	lbs.	ozs.	lbs.	lbs.	lbs.	ozs.	lbs.	lbs.	lbs.	ozs.
March	..	..	..		14,795	1,404	10	8	..	..	..	
April	161,087	14,637	11	0	134,883	12,708	10	9	158,936	14,686	10	10
May	279,978	26,524	10	9	326,062	30,921	10	8	455,936	43,768	10	6
June	297,592	27,614	10	12	407,315	38,611	10	8	490,890	45,980	10	10
July	238,788	22,118	10	13	397,020	37,789	10	8	411,725	38,384	10	11½
August	200,528	19,511	10	4	362,117	35,568	10	2	344,859	33,412	10	5
September	135,444	14,102	9	10	298,576	31,197	9	9	302,037	31,415	9	10
October	112,425	12,699	8	14	212,257	23,823	8	14	237,460	27,155	8	12
November	34,955	4,128	8	7	113,745	13,451	8	7	127,009	15,333	8	5
Total	1,460,797	141,333	10	5¼	2,266,770	225,472	10	0	2,528,852	250,133	10	1

Month.	Mickleover, 1874.				Holms, 1874.				Rooksbridge, 1874.			
	Milk.	Green Cheese.	Milk to 1 lb. of Cheese.		Milk.	Green Cheese.	Milk to 1 lb. of Cheese.		Milk.	Green Cheese.	Milk to 1 lb. of Cheese.	
	lbs.	lbs.	lbs.	ozs.	lbs.	lbs.	lbs.	ozs.	lbs.	lbs.	lbs.	ozs.
March	..	..	..		..	..	..		121,076	12,175	10	0
April	82,550	6,859(?)	12	0(?)	..	..	..		183,165	17,036	10	11
May	219,763	20,729	10	9½	82,776	7,697	10	12	302,004	30,141	10	0
June	223,781	20,774	10	12	174,293	16,389	10	10	280,453	28,428	10	0
July	177,801	16,389	10	13	158,246	14,963	10	9½	232,381	23,985	9	12
August	128,049	12,129	10	9	135,602	13,432	10	1½	211,902	23,112	9	3
September	117,910	12,015	9	13	128,550	13,392	9	9½	199,354	22,960	8	11
October	93,243	9,971	9	5½	101,095	11,209	9	0	?	?	?	
November	35,425	4,016	8	13	36,407	4,206	8	10½	?	?	?	
Total	1,078,522	102,882	10	7½	816,969	81,288	10	0¾	1,530,335	157,837	9	11

Adding the whole of these figures together, I find that from 9,682,245 lbs. of milk used in these factories 958,945 lbs. of green cheese were made, being at the rate of 1 lb. of cheese from every 10 lbs. $1\frac{1}{2}$ oz. of milk, a result which compares favourably with the 10 lbs. 8 ozs. of milk to every lb. of green cheese made on the Somersetshire farm, to which reference has already been made.

This Report on Cheesemaking in Home Dairies and in Factories ought not to be closed without a reference to what may be called the general milk industry of the country. There were last year in England alone, according to the published Tables, 1,614,477 cows. These had to be milked night and morning, and needed therefore the services of probably nearly 200,000 milkers. This is an enormous daily task, and it is surprising that invention has not yet contrived any efficient substitute or aid for the mere hand by which the work has hitherto been always done. In this laborious way we may probably assume there is on an average about 420 gallons annually drawn per cow. This is, indeed, most likely more than is yielded annually by the average cow beyond the requirements of its calf. And considering the comparatively low production of Hereford, Devonshire and Sussex, and some other counties, the quantity of milk to be dealt with in English dairies upon the whole is probably not more than 650,000,000 of gallons annually. Of this quantity, if the average daily consumption of a mixed population be put at one-fifth of a pint a-piece each day (see vol. iv., Second Series, p. 95), or nearly 9 gallons annually, we may suppose that our $21\frac{1}{2}$ millions drink nearly one-third of the milk we produce, and that not more than 450,000,000 gallons remain for the manufacture of butter and cheese. Take now the counties of Cheshire, Staffordshire, Warwickshire, Derbyshire, Gloucestershire, Somersetshire, and Wilts, in which there were, in 1874, 454,672 milch-cows—if we may put all the milk used in the cheese-dairies of Lancashire, Shropshire, Leicestershire, and Berkshire against so much of the milk of these seven counties as is not used for cheese-making, then the whole cheese-making of the country is represented by the 450,000 cows or more of the seven counties I have named. The cows of these counties yield probably more than the average quantity of milk, and looking at the fact that in cheese districts the calf is taken away earlier than elsewhere, and that the breed encouraged is such as gives quantity rather than extreme richness of milk, we may fairly assume the average yield of a cow to be 480 gallons annually here. This makes the quantity of milk employed in cheese-making in this country nearly 220,000,000 gallons

annually—equal to the manufacture of nearly as many lbs. of cheese—a quantity which does not now very much exceed that which is at present annually imported from abroad.* It must be admitted that the possibility of adding 10*s.* a cwt. to the value of this great manufacture, of taking 2*s.* or 3*s.* a cwt. from the cost of it, of doing away with the labour of some 10,000 dairymaids, and setting them free for the wants of other increasingly urgent employment, are most important considerations, both socially and agriculturally. It is not imagined that the whole of this great industry will ultimately concentrate and accumulate in factories; but it seems certain that, except where landowners are willing, at considerable expense, to provide the necessary home equipment, the course of events must tend that way. The superiority of the early and late makes of cheese, where large quantities of milk can be dealt with from the beginning till the end of the season —the superior quality throughout the year where the manufacture is in the hands of the highest skill assisted by the best-arranged contrivance—the diminished cost of manufacture, especially in respect of labour—the higher prices that are earned per gallon by the factory, are together certain ultimately to have this result.

This is no proposal to place quantities of live-stock under central management. Direct ownership, and the constant personal anxiety and care which only this will ensure, are necessary for the prosperous condition of the live-stock of the farm; its management could not be safely undertaken by a company. But it is simply a manufacture that is contemplated, in which the end depends upon the behaviour of a raw material under the well-known processes to which it is subjected. There is nothing whatever in the nature of the subject to take it out of the rank of ordinary manufactures—nothing to hinder us from anticipating that the greater economy and profit of operation on the greater scale, which are always realised in those, will be also realised in this. Certainly to anyone who comes into the dairy, of say even a 200-acre farm, during the last two months of the cheese-making season and sees the little mess of curd lying under its cloth in the cheese-tub just ready for the press—the whole daily result of all this great apparatus of milk-room, cheese-room, boilers, ovens, dairymaids, and what not, which has to be maintained—it must seem plain that the factory which unites the work of 30 or 40 dairies in a single apartment, with one, two, or three hands for the whole of it, must ultimately succeed on the score of both economy and profit.

* The import of cheese in 1872, 1873, and 1874, was 1,060,130, 1,355.267, and 1,488,223 cwts. respectively.

VII.—*In Memoriam.* By J. Dent Dent, of Ribston Hall, Wetherby.

Scarcely a month had elapsed from our last Council Meeting before death removed from our chamber three of its best known occupants; and those who are left will miss the familiar presence, the friendly counsel, and the judicious help of Mr. Torr, Lord Kesteven, and Mr. Holland.

Of Mr. Torr, of his energy and genius, his heartiness and zeal, which always met every difficulty with cheerfulness, and a determination not to be overcome by it, another pen than mine will write.

Lord Kesteven, once President of the Poor-Law Board, brought to our deliberations great Parliamentary experience, and an acquaintance with rural affairs and the conduct of country business which was of frequent value. In him strong common sense and knowledge of men were united to a hearty pleasantness of manner and great frankness and geniality of disposition. A feeling of weak health made him decline the Presidency, when it was suggested that he should be nominated, but he was always willing to take his share in the work of the Council; and those amongst us who were with him last December, and found him kindly and ready as ever, and then saw him presiding over the deliberations of the Taunton Committee, and endeavouring to adapt the views of the local authorities to the requirements of the Society, little thought we should never more meet the hearty shake of his hand or listen to his cheery voice. He was a thorough type of the best class of English country gentlemen; fond of field sports and the occupations of a rural life, and yet ready to give up any amusement for the higher duties of his position: whether to preside on the Bench at Quarter Sessions, or to take his share in the deliberations of Parliament and the cares and anxieties of a laborious public office.

Mr. Holland was of a different type to either of those whom I have named. Quiet and gentle in manner, he was a martyr to ill health, and, during the time I knew him, was always more or less a sufferer from gout. But, under that quiet and somewhat reserved exterior, there was a great kindness of heart, an earnest desire to do good, a strong vein of humour, much self-reliance and perseverance. Whether as an experimental farmer, working on his strong clays with the steam-plough, in the early days of its development, or amongst his Shorthorns and Shropshire sheep, for which, at one time, he had a great and well-merited reputation, the quiet energy was

always at work, seeking out what was best and most profitable for his much-loved pursuit. He was ever anxious to promote the social and moral welfare of his labourers, and he spared neither labour nor expense in providing them with comfortable homes, as the first foundation of their prosperity and well-being. In Parliament he was not one of the so-called "farmers' friends," who are either leaders or followers of every cry that, from time to time, is raised; but he had the courage to stand out boldly against what he thought were imaginary grievances, and, notably in the case of the Corn Laws, to hold very different opinions from those which were entertained by most agriculturists of the day. When the repeal of those laws became inevitable, the proposition he made to his tenants was eminently characteristic of Mr. Holland as a landlord—it was, that their future rents should vary with the price of wheat: this was eagerly accepted by the tenants, and for two years had the effect of reducing the rents 20 per cent.; but, under the same arrangement, the rents in 1853 increased 10 per cent., and then Mr. Holland volunteered to recur to the old fixed rents. Many more instances might be given of the liberal spirit which characterized all his dealings with his tenants; but it was not for this alone that he was esteemed—it was the genial kindly spirit that actuated him in all his intercourse with them which made him so revered and loved; and they all felt, and still feel, that the strongest tie between them and their landlord was that he was their sincere friend.

The technical education of the farmer was with him a lifelong cherished pursuit. The College at Cirencester owes to him an everlasting debt, and the good which it has done and is now doing is the result of his resolution and self-denial. He did not limit his ideas of the duties of the Royal Agricultural Society to its annual exhibition of stock and implements, but was anxious, by its means, to raise and improve the technical education of the English agriculturist; and with a steady undeviating purpose he held on to this up to the last Council Meeting which he attended. It was at this Meeting he announced the first results of the scheme offering scholarships to boys at our public schools who should pass a satisfactory examination in elementary agricultural subjects, and to which he had alluded in his address to the boys of the Bedfordshire Middle-Class Public School last year. He then said, "To study agriculture you must have practical work, and the difficulty is to get pupils to afford the time for practical education in agriculture. The only way in which this is to be met, and effectually met, is by our Society giving scholarships for the purpose of supporting, to a certain extent, those who are intended for an agricultural life hereafter,

and enabling them to attend some college, such as the Agricultural College at Cirencester. The arrangements are commenced, and I hope, if I have the opportunity of addressing you again, and of hearing of what has been done in Bedford at the Middle-Class School, I shall also have the pleasure and satisfaction of finding that agriculture has found its way into the teaching of this building, and that some scholar has distinguished himself in the study of practical agriculture, and has gained one of the scholarships to which I have referred." This desire was realized in the first year of the establishment of these scholarships, and it fell to Mr. Holland's lot to announce the fact to the Council, and to express the hope that this connection between the Royal Agricultural Society and the public schools, so happily commenced, might widen and extend in each successive year.

There were some who thought that his delicacy of health and his quiet reserved manner would have interfered with his efficiency in the Presidential Chair: but those who met him, either at the Council or in the General Meetings of Members, know how fairly and firmly he held the reins, how ready he was to listen to any well-founded suggestion; and yet how he could check irrelevant or discursive talk by a few well-chosen words. It gave him very great pleasure to fill the office of President, and to a member of his own family he said "it was the one honour in the world he had wished for." His year of office had led him to think the Society had perhaps outgrown its Charter, and that some relaxations in this might increase the usefulness of the Society. Almost his last act in the Council was to take part in a movement in this direction, hoping thereby to extend, still farther, the usefulness of our action.

Above all he was a thoroughly loveable man, and the gentle kindness and courteous manner of his intercourse with men has made those who worked with him in public, honour his ability and deeply venerate his memory.

Ribston Hall, Jan. 26th, 1875.

VIII.—*The late William Torr: a Compilation from many Sources.*

The death of William Torr, at the age of sixty-six, has created a blank in the agricultural world that is not likely to be filled up in this generation. He was born at Riby, in North Lincolnshire, where his forefathers had resided for several generations; he was educated in Yorkshire, but left school about the age of

sixteen, owing to delicacy of health. Had he been able to continue his studies, he would probably have taken up the law as the profession to which his inclination led him. On his health being restored, he made a series of annual travels, in company with his younger brother (at present M.P. for Liverpool), through England, Scotland, and Ireland; Belgium, Holland, and other parts of the Continent. In all of these journeys he took a marked interest in the different systems of agriculture, and the various breeds of cattle and sheep; and he no doubt then laid the foundation of that extensive and critical knowledge which through life he displayed in the different branches of stock-farming and general agriculture. He farmed over 2000 acres of good land, a large portion of which had been rented by his family for a century and a half; he left a herd of 100 pure-bred Shorthorns, for half of which 10,000*l.* has been offered since his death; and out of a flock of 1200 breeding-ewes, 500 were pure Leicesters, direct descendants of Bakewell's original stock. On his farms, in the arrangement of the buildings, as in the farm-roads, the gates, and the system of drainage, the originality of the true English farmer's mind was alike displayed.*

Mr. Torr became a Member of the Royal Agricultural Society in 1839, the year after it was founded; but for several years previously his face and voice were well known at the Meetings of the Highland Society; and he was an authority in his district, especially on sheep and Shorthorns, ten years before he was elected on the Council of the Royal Agricultural Society, viz., at the Annual Meeting in May, 1857.

His influence was soon felt at the Council Meetings of the Society, and in less than six months he succeeded in extending the time-honoured rule which prohibited the exhibition at the Society's Meetings of bulls more than four years old. The result was to increase the maximum age to six years; and it was not until ten years later that the restriction was abolished altogether. Space will not permit Mr. Torr's career on the Council of the Society to be closely followed; but it may be observed that his efforts were generally directed to the abolition of restrictive enactments. Thus, in 1861, on his motion, the Show-yard was first opened during the Judging of the Live Stock—gratuitously to the Members of the Society, and by payment of 1*l.* to the public. This was his first successful endeavour to promote one of his pet projects, which he termed "open-judging." In 1862 he attempted, though ineffectually, to dispense with the preliminary veterinary examination of

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* Mr. Torr's farms were described in vol. v. pp. 415-442, of the Second Series of this Journal.

horses; but five years later he was more successful, in conjunction with Mr. Milward. Recent discussions will give a more living interest to his last attempt bearing on these questions. In March, 1870, he gave notice that he would move "that judges of live-stock be provided with catalogues, in the same manner as judges of implements now are;" but the opposition of a section of exhibitors induced him to modify his resolution so that the names of the exhibitors should be withheld, but that the pedigrees of the entries should be given. This compromise did not satisfy his opponents, while it alienated his supporters; but the indirect result was the existing rule that each entry in the Shorthorn classes should be certified to have not less than four crosses of blood registered, or eligible to be registered, in the Herd-book.

At the time he died, he was on most of the important Committees, viz., Finance, House, Stock Prizes, Implement, Country Meeting, Showyard Contracts, and Selection. He was also a very active Member and Trustee of the Smithfield Club, and was well known as a Judge of Live-stock at the principal Agricultural Shows of the three kingdoms, and at those organised in Paris by the late Emperor of the French.

The value which the Council of the Society attached to his opinion on practical matters was attested by his frequent appointment on the Committee of Inspection to visit the sites offered for the Annual Country Meetings, as well as by his selection as one of the Judges of Farms at the first competition carried out under the auspices of the Society, viz., in connection with the Oxford Meeting of 1870. As a large producer of beef and mutton, of original views and practice on the various systems of transport of live cattle and dead meat, he was called to give evidence before the select committees of the House of Commons on those subjects, which have been appointed since the outbreak of the cattle-plague in 1865. As a feeder, he attached little importance to foot-and-mouth disease; but he was careful not to purchase animals at fairs and markets, except as a matter of necessity; and he was especially severe in his estimate of the influence of small dealers in cattle, sheep, and pigs, in spreading contagious diseases of the animals of the farm throughout the country. He also attached considerable weight to the possibility of the importation of disease from foreign countries under the regulations that were in force in 1871, and in July of that year he called the attention of the Council to the relaxation of the restrictions on the foreign cattle-trade, which had recently been made by the Privy Council, and to the injury which may have been thereby inflicted on English herds.

It was his boast, not without reason, that everything on his

farm was thoroughbred, even game-fowl; and his half-wild flying black ducks were carefully brought down to weigh no more than a teal, and pitilessly condemned if they showed a single white feather.

A writer in the 'Agricultural Gazette'* has well observed, "But the live-stock of the farm did not monopolize his active mind, for his leisure moments were frequently occupied in devising improvements in farm-implements. Among other achievements in this direction, he invented one of the first convex mould-board ploughs, long celebrated as the W. T. plough; a farm-gate which won the prize of the local committee at the Warwick Meeting of the Royal Agricultural Society in 1859; a pig-trough that was patented by Messrs. Crosskill, of Beverley; and a spring waggon, an old specimen of which was the lightest in draught of those competing for the Royal Agricultural Society's Prizes at Manchester in 1869. The original of this waggon gained the 20*l.* prize offered by the North Lincolnshire Agricultural Society at their Gainsborough Show in 1845." He aimed at doing everything on his farms, from the form of a hedge to the fashion of a gate, in the best possible manner.

But with this minute attention to details, as minute as on a fancy or model farm, carried out with restless energy, he was as far as possible from a stay-at-home, ring-fence farmer. He probably travelled more and farther, on horseback, by sea, and by land, than any farmer of his generation. His extraordinary energy, his universal agricultural knowledge, the fluency and force of his tongue—whether in conversation, or in a set speech, or in debate—were, indeed, something truly astounding to a stranger.

He was seen to most advantage at home; as a host, he entertained continually from every part of the kingdom, and of the world; and seemed never tired of feeding and lecturing, not only his friends, but his friends' friends and most distant acquaintances, if only they loved agriculture and listened to his clever dissertations. He did not always please. He was too positive and too prejudiced to be popular; but he impressed everyone with a sense of his ability, and conquered the prejudices of many when they shared his bountiful and old-fashioned hospitality. He never wrote anything; for he entertained "strong objections to everything in the shape of paper farming;" but he would have made a most popular Professor of Agriculture, had Oxford indulged in such a luxury; and the shorthand writers have fortunately preserved for our use his instructive practical lecture on "Sheep *versus* Cattle," from which the above quotation has been drawn.†

* December 19th, 1874, p. 1627.

† 'Journ. Roy. Agric. Soc.,' Second Series, vol. ii. p. 549.

Great farmers are like great actors, they live only in the memory of their cotemporaries, unless like Bakewell, Colling, Booth, Bates, and Jonas Webb, they stamp their names upon some tribe of live-stock. Thus it will doubtless be with William Torr, although his name has been before a constantly extending circle of agriculturists for nearly forty years; for he went everywhere, and wherever he went made himself heard and remembered by his ceaseless energy, his decided opinions, his caustic replies, his happy speeches, his perpetual flow of talk, rich in anecdote, and illustration of every agricultural question.

"The first time I saw William Torr," writes a Yorkshire implement-maker, "was about forty years ago, at a dinner of the Highland Agricultural Society, at Berwick, where the Duke of Northumberland was in the chair; he was sitting next to and carrying on an animated conversation with the Duke of Roxburghe (Dukes were rarely seen at public gatherings in those days), and I never saw him look so well. He was a slim young man, with dark hair, a ruddy complexion, very well dressed, in a white waistcoat. His eyes sparkled with animation, he so evidently enjoyed the pleasure of being able to teach a Duke something; even then his voice was loud and confident, and he talked fluently and well. He came round the Showyard the next day, and looked at my stand of implements, which had been so much appreciated that they had all been sold and paid for; on hearing this he expressed much surprise, for, in the high tone that great farmers held at that time towards implement-makers, he found many faults with everything. But that was his way; to listen to him one would think that no implement-maker had ever produced anything he had not originally invented. I found afterwards that this depreciation did not prevent him from adopting the best implements on his own farm when their utility was proved. At one time he had a great prejudice against iron ploughs, and professed to prefer those made under his own directions by the village blacksmith; and he frequently declared before he adopted steam cultivation that it never could pay.

"In his own neighbourhood he was for more than thirty years a great authority on every farming and breeding question, and was treated with as much deference as if he had been a landed squire in some counties. He was too arbitrary and rough in his tongue to be popular with his equals and inferiors; but no stranger ever visited him at home that did not go away delighted with his vigorous galloping way of showing his farm, and with his overflowing hospitality."

An agricultural author writes: "I made Mr. William Torr's acquaintance about the year 1846, he was then in the prime of

life, living at Riby, exceedingly active, up early to ride out farming, sitting up later than suited me to talk over what we had seen, what he had done, and what he was going to do at Aylesby, to which he shortly afterwards removed. He had a famous lot of blood-ponies, and mounting me on one of the best, took me over the land at a hard gallop, often as straight as if we were riding to hounds. As he rode he lectured; one question was sufficient to bring out an essay. He was one of the best talkers I ever met in my wide travels.

"No one could have had a better guide to North Lincoln, a more eloquent lecturer, or a more genial host. His fixed idea was doing everything on his farm in the best manner. I afterwards visited him at Aylesby, where the house and farm-buildings were laid out from his own plans. They were full of ingenuity and thoughtful contrivances. His labourers' cottages were very good. I remember that he was very severe on the cupboards and closets of Prince Albert's model cottages. He had quite a mania for originality, and in 1854 could by no means reconcile himself to the important position the great implement-makers were taking up.

"He was very proud of his pure Leicesters, of which he had purchased in 1848 thirty ewes at the sale of Mr. Bakewell's lineal representative. He was very strong on the importance of constitution, as well as of pure pedigree, in cattle and sheep."

His Lincolnshire friends, after the Gainsborough Show of the North Lincolnshire Agricultural Society, in 1864, subscribed and presented him with a testimonial, in the shape of a full-length portrait of himself, in recognition of his services to agriculture.

His picture was well drawn by 'The Druid,' so late as 1870, in the following sentence*:—"When behind 'the iron horse,' or flying over the grass by the roadside on the 'woldsman's pony,' he makes very little account of time and space; and what with home (to wit, calling his orders out of his bedroom-window at 5 A.M.) and county and Royal Agricultural business, few men have thrown such an intense earnestness into life, or worked so hard for others. At home, if you see a distant and ever-moving figure in the park, and not unfrequently in shirt-sleeves for coolness, among the heifers or the ewes, there is no mistaking 'Torr of Riby,' although he is not exactly 'composed' after his presentation-portrait by Knight, R.A., a 340-guinea tribute from his friends. Inventing a prize gate, or sketching out a new set of farm-buildings, or planning a model-cottage, or giving evidence on cattle transit before the Privy Council, or making an after-dinner speech, or rising on a point of finance,

* 'Saddle and Sirloin.'—North, p. 474.

or a change in the prize-sheet at the Smithfield Club and Hanover Square, come equally natural to one 'with the concentrated energy of half-a-score of men.'"

In a word it might be said of him—

> "He was a man, take him for all in all,
> We shall not look upon his like again."

IX.—*Wool in Relation to Science with Practice.* By Earl Cathcart.

Contents.

Introduction.—Breeding, feeding, and wool, are three words that sum the essentials of sheep-husbandry, which the foreigner tells us truly is the basis of our agricultural system. Sheep-husbandry—meat and wool—is, without doubt, more than ever characteristic of English farming—the largest return in the shortest time. But whilst their great importance is fully acknowledged, the design of this essay touches the two first of these essentials incidentally only to dwell chiefly on the quality of English wool, as affected by its farm preparation for market, and this in relation to Science with Practice.

I would endeavour for the first time in history to bring the English wool-consumer and the English wool-grower into friendly relations, uniting them on the only sound basis of a mutual understanding of intercommunity of interests—promoted by free association and co-operation.

Mr. Stephens,* one of the most practical writers in the whole range of English agricultural literature, tells us—it would be well for wool-growers to receive lessons from wool-staplers: wool-growers at present grow their wool in ignorance of the requirements of the home manufacture, and consequently prices and interests are seriously affected. As the sequel will show, the truth and prescience of these words have been practically laid to heart by our shrewd Colonial brethren, and by our

* Author of the 'Book of the Farm.'

American cousins: on some parts of the Continent the knowledge of wool is educationally treated as an important branch of science. Mr. Darwin tells us:—Lord Somerville, speaking of what breeders have done for sheep, says:—"it would seem as if they had chalked out upon a wall a form perfect in itself, and had then given it existence."* In Saxony the importance of the principle of selection in regard to Merinos is so fully recognised, that men follow it as a trade: the sheep are placed on a table and are studied, like a picture by a connoisseur; this is done three times, at intervals of months, and the sheep are each time marked and classed, so that the best may be selected for breeding. My object is thoroughly practical: I have lived, farmed, and observed for twenty-five years in a district in which the wool is famous;† but I claim no authority of my own: it has been well said that "the knowledge of smatterers is but mixed ignorance."‡ I do, however, claim that I have gathered and put together much important and authoritative information, and some other matter that is calculated to excite curiosity and to suggest inquiry. In the words of the Ettrick Shepherd—"the subject has almost made a sheepfold of our understanding."

At the outset, I must ask the reader to bear in mind throughout this inquiry, that however much I may digress—and, amongst other things, I must make a flying visit to the flocks of the world, and especially to our most distant colonies—I shall always return to the main channel of my indicated course, which leads directly to the solution of two very practical questions: (1) Does the English farmer now prepare his wool for market to the best advantage? (2) And if not, where practically shall we find the farmer's shortcomings?

The Wool of the World, as exhibited at Paris at 1867, and at Vienna in 1873, I shall, to some extent, consider here as introductory matter: I may have more to say when I come to treat the subject practically. At Paris, in 1867, the collection of wool from almost all parts of the world under one roof, rendered two facts very striking: the one, the absence of any adequate substitute for English deep-grown wools; and the other, the slow rate of improvement in those wools of foreign growth, which are used in aid of the lower qualities of English combing-wool.

American Opinion.—Our American cousin, to whom I have previously referred, is keenly alive to the importance of "fine wool husbandry," although he is not yet awake to the advantages of free-trade: there have long been in the United States National and State Wool-Growers' Associations: the Government Department of Agriculture consults these Associations, and I need scarcely

* Darwin's 'Origin of Species.' † See p. 320. ‡ Lord Chief Justice Coke.

say that they do not fail to exercise the characteristic political virtue which is described in this phrase—"admirably outspoken." It is said a uniform manner of preparing United States' wools for the market is very desirable ; it would save trouble, and give character and stability to the business.*

The Americans say, further, considering the importance of the combing-wool manufacture to England, it is surprising how little attention is given by agriculturists to the qualities or quantities of the wool produced. The American farmer is plainly told that it is not only interesting, but it pays him to know and understand the requirements of the wool manufacture. In the United States home-wool is the foundation of the home-wool manufacture, which clamours for more! There at least it is understood and proclaimed, that mutual interest cordially unites the wool-manufacturer and the wool-grower.

The Austrian official reports of the Vienna Exhibition of 1873 remind us that England is the first manufacturing State of Europe ; and her manufactures of woollen goods are so important, that the mighty Island Empire is at the apex of this industry also. The wool growth of Europe is now superseded by the abundance of Australia, the Cape, and La Plata. A characteristic of wool is its transportability ; on an average, its price is twenty or twenty-five times as high as that of corn, hence trans-oceanic competition is easy, and the wool trade is an essential part of the commerce of the world.† It is calculated that England now annually consumes more than one fleece for every inhabitant : the consumption of wool is steadily increasing, and already quantities of so-called artificial wool are brought into use ; clean fleeces being required to work up this unstable shoddy.

The general consumption of wool in England is said to be 4½ lbs. per head of the population—some 3 lbs. per head in Germany. In Europe, there is no country but Russia which is capable of greatly developing in respect to quality and quantity the production of wool : London is the central market for the wool trade : auctions are held where buyers congregate from all parts of the world. England being the largest consumer of wool, the fluctuations of the European wool trade have from olden times depended on those of the English market.

"The commercial movement of the wool trade in the leading states of Europe and the United States of North America for the year 1870, is exhibited in the following Table (p. 312).

"As to the consumption of the most important European States, England, engaged in progressive development, and

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* Department of Agriculture, United States of America. 'Monthly Reports.' Washington, 1873.

† Professor Carl Richter. 'Vienna Reports,' 1873. Part I., p. 795.

France stand at the head of the wool manufacture. In the year 1870–71, England manufactured 330,000,000, and France 300,000,000 pounds of wool of all descriptions." *

	Imports.	Exports.
	lbs.	lbs.
England	238,820,852	94,911,916
France	167,422,200	25,711,412
Belgium	147,092,128	66,543,920
Germany	90,000,000	25,000,000
Austria	21,680,900	16,392,700
Netherlands	16,991,972	13,906,260
Russia	2,648,700	28,558,577
North America	62,202,714	12,067,689

One other important lesson English farmers may learn from the Vienna Exhibition of 1873: leaving out of present consideration the very suggestive terms "Lincoln Zackels," "Southdown Silesians," and "German Southdowns," we are taught that in Germany, as in England, the tendency towards breeding for weight is very evident: trans-oceanic competition in wool-growing causes German sheep more and more to be bred for their meat—wool and meat.

Let me here exhort the English farmer and ram-breeder to lift up his heart to profit by the lesson he is for the first time taught by an Imperial census, that he is a unit in an empire that numbers 235 millions of British subjects, scattered over 8 millions of square miles, distributed upon every considerable portion of the face of this earth; and therefore it is profitable, before averting our theoretical glance from the wool of the world, to study the universal trade requirements, which should be *the wool-grower's aim and object.*

We are told by authority:†—

"There is every probability that the worsted manufacture will long be able to afford remunerating prices for any quantity of good, serviceable combing-wool which the world may be capable of producing.

"It is desired to call the attention of all flock-masters to the fact that wool, to be fit for combing purposes, and to obtain the higher prices which such wool commands, must possess qualities which, in most instances, can be imparted to it.

"It may be useful to draw attention to a few general observations on the qualities of the staple, which all owners of sheep ought to aim at, so far as the nature of climate, soil, and other circumstances may permit.

"The wool most in request, and always fetching the highest price, has a staple from four to ten inches long, according to its fineness; it ought to be, as far as possible, uniform in quality throughout its whole length; bright

* Census of England and Wales, 1871. 'General Report,' vol. iv., p. vii. The vastest census that has ever been taken in one empire.

† 'Circular Address and Reports' (for all parts of the world). Bradford Chamber of Commerce. 1869.

and lustrous* in appearance, *or* soft and kind to the touch; of good spinning qualities, and free from burrs or other vegetable fibre.

"Where possible, the breed of sheep should be improved by the introduction of carefully-selected English rams.

"It is most desirable to obtain the whole natural length of the staple by ~~only~~ clipping the lambs or sheep once during the season's growth.

"When the sheep cannot be pastured all the year round upon succulent grasses, a constant supply of artificial food will prevent the staple becoming tender.

"*The two last-mentioned points are of the greatest importance; for insufficient food during one season, and frequent clipping, more than anything else, deteriorate the quality and depreciate the value of otherwise good and useful wool.*

"The sheep should be well washed before they are clipped, and the fleece properly docked or cleaned.

"It is also desirable that a proper classification of wool should be made in packing, and that the packing itself be thoroughly trustworthy and honest."

Agriculturally, *the history of Wool and the Wool-trade*, for centuries the principal craft of Great Britain, is particularly interesting and instructive; and it is essential to a right and comprehensive understanding of an important branch of the subject now under consideration. Aided by geographical position, and favoured with mineral and vegetable wealth, the energetic spirit of the mixed British race triumphed over the ruinous restraints of so-called statesmanship and every conceivable legislative blunder. Until the fourteenth century England exported wool and imported woollens. Then the Flemish manufacture attained its zenith; glutted with wealth, these prosperous people became discontented; and industrial insubordination and endless revolts drove the life-blood of trade, sensitive capital, away from their doors, established our staple manufacture, and placed in the English House of Lords its typical woolsack. The paths of peace are essential alike to commerce, to manufacture, and to agriculture. Twice over, in the history of the English wool trade, religious bigotry and the Inquisition drove the best and most skilful craftsmen of the Continent to share our insular freedom: bigotry tore up by the roots the tree of industry, because it liked not the vigour of the most promising shoots. Here we have a fine example of the certain action of freedom in producing beneficial co-operation. Checked during our own revolutionary times, the wool trade steadily increased during the whole of the eighteenth century, and culminated when steam and machinery were introduced and all restrictions removed. Cotton-spinning, whilst it reduced the woollen manufacture to the second rank in our textile industries, nevertheless gave fresh impetus to the woollen-trade; so true it is that the creation of any one

* Lustre is not colour; it is intrinsic silvery brightness, not lost in manufacture. Between good and bad wool in this respect there is as much difference as between a polished silver plate and a wooden trencher.—*Mr. Turner.* See note, page 346.

exceeding industrial momentum is certain to excite on endless parallel and converging lines an unexpected and often marvellously rapid progress.

The four great landmarks in the history of English wool and woollens are then unmistakably these:—the Flemish emigration in the time of Edward III.; the Continental endeavours to stamp out the Reformation; the panic caused in France by the revocation of the Edict of Nantes (1685), which Edict tolerated Protestants, its revocation drove into this country the most skilful spinners and dyers of silk, linen, and wool; and lastly, the introduction and multiplication of steam-power and machinery.

I now proceed to map in practically a few more suggestive historical details. Spanish wool was introduced into Flanders to replace the English wool consumed at home: in 1521–49 home wool was in such demand that complaints arose that the country was being depopulated to make sheep-walks: some eighty years afterwards Spanish wool was in demand all over Europe—the wool of the now famous Merino. The Reformation increased the manufacturing classes, and the English trade attained the highest pitch of prosperity. The Act 8 Elizabeth, c. 6, shows the extreme jealousy of the English wool-producer; the export of sheep was strictly forbidden: later, an Act of 1616, prohibiting the export of "white cloth"—undyed cloth—drove the English sheep-farmer from the fleece to the carcass, and gave a new impulse to sheep-farming—high feeding, more flesh, more wool—but this at the expense of the fineness and softness of the staple.

In 1672 (12 Charles II. c. 32), exportation of wool was made felony. Meanwhile Spanish wool was brought to great perfection—a truly "golden fleece"—and was introduced into England. In 1665 our export trade was only nominal; many of our best hands emigrated: the Plague and the Great Fire made matters worse: the law meddled and coddled: and in every direction it bound the masters, it tied the hands, it hindered the looms, it stinted the raw material, interfered with the clipping, regulated the packing, and afterwards it dictated the fabrics into which alone the raw material might be woven: and lastly, in 1679, the law, as a climax of absurdity, insisted upon burying manufacturer and craftsman, as well as everybody else, in shrouds of sheep's wool. There was a mania for monopoly. So late as 1792 the statute-book contained no less than 311 laws relating to wool and woollens. In 1680 the Dutch were ransacking the world for raw material. The Revolution of 1688 gradually restored prosperity to the English wool trade: the Manchester Act, 1736 (9 Geo. II. c. 4), annulled an Act passed 15 years before against cotton as opposed to wool, and thus by an Act passed in favour of freedom for cotton, an impetus was actually given to the woollen trade. In 1802 the multiplication of machinery caused industrial

riots: four years afterwards a Committee of the House of Commons reported in favour of the free use of machinery. War in Spain caused the Spanish wool-clip to decline; but by this time the famous Merino had found his way over Europe, and, further, he had reached our most distant colonies, there wonderfully to increase and prosper. The history of the more recent importation of wool into this country is simply this: the German supplanted the Spanish, and then both gave way to our Colonial imports, which in 1825 were admitted duty free.* It was said, years ago, with truth and prescience, "that with labour on the sheep, and more care and labour in cleansing the wool, Colonial wools might successfully rival those of Saxony and Spain."†

The right knowledge of anything in great measure depends upon the knowledge of its history, and the more we study the history of this subject the more we are taught that wool and the wool trade was the foundation of our English commercial prosperity.

The 'Journal' of the Society as it relates to our Subject.—I now should, before going farther, run through the 36 volumes of the 'Journal of the Royal Agricultural Society,' to pick up such manna as may serve to feed out my present object: there are here and there spasmodic indications of a desire to consult the wool-stapler and the wool-trade, but no sustained effort. In the 6th volume Professor Wilson gives us a paper "On Sheep and on Wool, its Character and Value:" he deals more with details than with principles; and, second-hand, the Professor works up information originally obtained for Board of Trade purposes. Mr. Smith, in the 8th volume, tells us to assist Nature by fitting the sheep to the soil, situation, and climate. Mr. Rowlandson (vol. x.) writes well "On the Breeds of Sheep best adapted to Different Localities:" but the good seed of conception is here rather sown on the stony ground of too limited execution. He mentions the "smearing," which Stephens calls a "filthy practice." The result of every inquiry undertaken by Mr. Lawes we receive with gratitude and respect; but his "Sheep-feeding Experiments" (vol. xii. pp. 13 and 16) are more directed to meat than to wool: he tells us, however, that in several lots where respective rates of increase of meat were nearly equal, there was great individual irregularity in regard to the growth and the weight of wool. The first volume of the new series contains a scientific paper, by Professor Simonds, "On Animal Parasites," interesting here because of the drawing of an Australian sheep-dip on a grand

* By Mr. Huskisson, after a severe struggle. Colonial wool free—in 1844 all wool free. In 1828 it was conclusively shown that freedom was beneficial to the Home wool-grower, because it stimulated trade and manufacture.

† See further on this subject, Bischoff, on 'Wool, Woollens, and Sheep,' London, 1842; 'Wool and Woollens,' Samuel Brothers, London, 1859; and 'Europe during the Middle Ages,' Hallam.

scale, suggestive as to the mechanical details in manœuvring large flocks, of pens, runs, and the use of decoy sheep (vol. ii.). That genial man, that admirable husbandman, my late friend Mr. Torr, gives his experiences in a lecture on "Sheep *versus* Cattle:" I shall have to refer to his influential opinions hereafter. I cannot now resist quoting two characteristic observations—"Different breeds of sheep have different tribes, which even the breeder cannot distinguish. . . . . It is my sacred resolve to keep the Aylesby flock pure, as it has been for something like 80 years." Mr. Dixon (vol. iv.), an admirably readable writer, sketches the "Rise and Progress of the 'Rent-paying' Leicesters." We have a portrait of our "shepherd king," Bakewell, and the famous maxim, "strong loin, strong constitution." There is also much about Sanday and Holme Pierrepont: it is very interesting and suggestive to trace the spread of the Leicesters. Passing over Mr. Tanner's interesting paper, "Climate and Sheep" (vol. v.), to notice it elsewhere—I find in the same volume, in the "Farm Reports," that Mr. Torr sent rams to England, Wales, Scotland, Ireland, France, Australia, California, Jamaica, and St. Helena. Professor Wrightson's Vienna paper, in the 10th volume, is noteworthy: but for a fitting conclusion to this reference to the 'Journal,' I return to Mr. Dixon, and his pleasant quotation of a Cumberland Dalesman's toast—which I heartily honour—"Pack sheets and ready money!"

The Science of the Subject must now command our best attention. What is science? It is generality as opposed to mere particulars, system as opposed to random, verification as opposed to looseness of assumption. Would that some world-famed Somerville might arise to write from an agricultural point of view 'A Connection of the Physical Sciences!'* Certain it is that agriculture bears a close relation to more branches of science than any other art. The branches should perhaps be treated as Professor Ansted has treated in this 'Journal' (vol. ii. N. S.) "Rainfall and Geology." We observe that this year the Highland Society of Scotland has made an advance in this direction; it offers a premium, according to merit, for the "Best Text-book on Agriculture as a branch of Physical Science, including the application of Botany, Geology, Chemistry, and Animal Physiology." A general characteristic of our day is the determined searching after principles: the spirit of investigation stalks throughout the land knocking loudly but impartially at the doors of the Hall and the Farm, and of the Parsonage and the Cottage. This extract from Mr. Leach's 1871 'Report on Wool and Woollens,' † is practi

* Chemistry—or whatever magnetism may be—now aids and simplifies mechanism in a manner that is startling. In delicate processes, cranks, levers, hooks, wheels, &c., are supplanted by the simple attraction of magnetism.

† Official Reports, London International Exhibition, 1871.

ally suggestive:—"There should be no vain boasting that a monopoly has been preserved in the heavier class of woollen goods. Time is fleeting, and changes are rapid in these advanced days; and before competition waxes keen in these national productions, it is wise to endeavour to estimate the losses we do suffer, and have suffered, from interlopers in other instances, and to ascertain their causes, in order to apply the remedy, and arrest the injury we run the risk of sustaining. And what is the remedy? *In one word, 'Education!'—education in natural and physical science.*"

By Chance, the Divinity of the ignorant, we are still too much influenced; by English farmers generally principles are not understood—their value is not appreciated:—"The agricultural improvement in Germany is due to the same cause that during a century past has been raising Prussia from a comparatively insignificant position to the first rank among the Powers of Europe, to wit, science and system. It is a spirit of careful economy, coupled with an understanding of the whys and wherefores of things. In agriculture it has manifested itself in the general diffusion of scientific knowledge among farmers, in the establishment of agricultural schools and experimental stations, where science and practical experience are so combined as to make them of the highest service to the community." *

Definitions.—Agriculture, an ancient, and until recently a Rule-of-Thumb Art, suffers from extreme looseness of definition: definition is the technical statement and explanation of the meaning of words. Every district has its own terms; and unfortunately writers on agriculture too often tender the first wordy small coin that comes to hand, never thinking whether or not it will pass elsewhere: we can only touch the fringe of this subject here; but it is to be hoped that something may be done, and that all writers will remember that agriculturally there is no reason why a literary coinage should not be put into circulation which would be gladly accepted by all the farmers of the English-speaking race.

This extract from the 1871 Report is suggestive:—"Unfortunately, the number of the denominations of the lengths of yarn, or the lengths of the skeins adopted in the different woollen districts, are as many as weeks in a year. To reduce these measurements into Yorkshire skeins per 'whartern' would be as 'Greek' to the West of England or Scotch foreman. This want of a common standard definition produces many hindrances to the general trade, and offers a fit subject for the consideration of our intelligent Chambers of Commerce."

Premising that staple means any one lock of wool that natu-

* 'Applied Science in Farming.' Professor Abwater, U.S.A.

rally sheds itself from the rest, we beg the reader clearly to understand that which is well explained in the 1871 Report:—

"The woollen and worsted trades are very dissimilar, the manufacture differs in almost every process.

"The work-people engaged in each require a separate experience altogether, whilst the machinery employed is as opposite in principle as woollen machinery is to that of cotton or silk.

"As a rule the 'woollen manufacturer'—and especially the maker of 'broadcloths' or felted goods—uses a fine-haired, short-stapled wool, and endeavours to produce from it a yarn, in which the fibres are transversely disposed to the axis, or length of the thread. The points or ends thus projecting from the exterior or circumference must be as numerous as possible. The limit of the quantity of fibres in a given length of thread desired is determined only by the tensile strength necessary for weaving and holding the fabric together, and imparting to the same the required firmness. This feature in 'woollen' yarn is termed 'pile,' and subserves two purposes. The first, that the felting process may knit together, or interlock this multiplicity of fibres into a compact mass of matted fabric; and the second, that from this same felted substance additional points may be subsequently raised to the surface in the finishing process, so that it resemble as much as possible a fine short fur.

"The worsted spinner's aim, on the contrary, is to elongate or stretch the fibres, and lay them parallel to each other, and thus produce a yarn which shall be even and strong, and yet be composed of few hairs or filaments.

"The character of worsted goods is estimated not only by the peculiar staple, or the properties which the various growths of wool or hair possess, but also by the fineness or length to which yarn can be spun, and the corresponding increased number of picks or shoots which may form a square inch of the fabric. In worsted stuffs the number of the warp and weft threads per square inch may be counted by the aid of the usual magnifying eye-glass. In felted dressed woollens, such as broadcloths, this is not possible, inasmuch as the threads are hidden from view by the felting process before referred to."

With regard to wool-stapling terms, I am favoured by the Wool Supply Committee of the Bradford Chamber of Commerce with information and observations as to the terms there understood by the wool-sorter, by whose trained eyes, delicately expert and nimble fingers, the wool of the various fleeces is selected and sorted.

On a Southdown fleece the sorts, in order of transverse division, would be called Breech, next Super, then Prime, and the rest Diamond.*

Taking a Leicester fleece, as an average of English wool, it would be sorted, and in Bradford named in order thus:

Breech, or 24's.
Brown, or 30's.
Neat, or 36's.—About the centre transverse division.
Blue, or 40's.—Transverse division, together with ridge of neck.
Fine, or 44's.—Part of neck and all on the shoulders.

* "It is now a fact generally admitted that English long wool has recently much deteriorated in the quality of its fibre; so that whereas ten to fifteen years ago a yarn might be spun to 52's, the same is now, with rare exceptions, possible without an admixture of a certain proportion of colonial or other finer wool."—1871 *Report.*

A hank * of worsted yarn is 560 yards in length. A pound of Breech wool will spin 24 hanks. A pound of Brown will spin 30 hanks; hence the names 24's, 30's, &c.

It must be observed, however, that the wool-sorting divisions in question vary according to the breed of sheep and the conditions of their keep, &c. On this point it should be observed that great attention on the part of the farmer should be paid to the keeping of their breeds of sheep pure and select, as by wide crossing even of good breeds, or crossing of a good breed with an inferior, a much larger proportion of the less valuable sorts of wool is produced.

In addition to the sorts hereinbefore described, which are all long-wool sorts, there is, fringelike around the edge of the fleece and especially at the centre of the sides, a short kind of wool or skirt, which is called "Shorts," or clothing wool.

Physical Geography.—The sheep is vitally influenced by all the movements which are constantly going on upon the surface of this earth—climate, waters over and under the earth, elevations, winds, rain, clouds, and the geographical distribution of animals and plants,—that is to say by physical geography. How much of philosophy there is in the common phrase, "the lie of the land"! temperature, rainfall, herbage, all, more or less, regulated by altitude; exposure and nature of soil as indicated by inclination and prevailing kind or by the absence of trees. To do justice to these subjects one should indeed be a philosophic Darwin and many other scientific gentlemen "rolled into one"! If, practically, the flockmaster does not consider physical geography, the sheep unmistakably tells him "I will not thrive." The starting-point, the essential question, then, is the perfection of the sheep in relation to the physical influences; the adaptability of the sheep to the land, of the kind to the run. The range of sheep-walk all over the face of the earth is practically unlimited, boundless. Mr. R. Smith in this 'Journal' (vol. viii.) tells us to assist Nature by fitting the sheep to the soil, situation, and climate: he tells us that a flock impartially divided and kept for twelve months on different soils, when put together again were found—excepting only the family head—to have lost almost all resemblance. I have before me Mr. William Brown's thought-engendering 'Map of the British Isles, showing the existing distribution of prevailing kinds of Sheep:'† there is no reason why a sheep and wool map of the world should not be constructed on the same instructive principle.

Geology.—The relations of the geological formations to the

* Mr. Turner (see page 346, note) says, a pound of wool off the shoulder of a good sheep will make five miles more yarn than a pound off the breech of the same animal.

† 'British Sheep Farming:' William Brown. Edinburgh: Adam and Charles Black. 1870.

nature of the water-supply of districts and countries, as we shall see, raise important economic questions involving the expenditure of thousands and thousands of pounds. Wool-brokers' reports constantly refer to droughty seasons abroad, and consequent large mortality amongst lambs. An Australian correspondent says: "I have seen a wash-pool that cost 10*l.* turn out wool cleaner and softer than another pool in another district that cost 5000*l.*: in the one case a clean country, and plenty of water, pure and soft; in the other, clouds of dust and rivers of hard water." I am indebted to Mr. Fairley, the obliging and able Consulting Chemist of the Yorkshire Agricultural Society, for the following generally suggestive note:—

"The softer the water, or the smaller the quantities of lime and magnesian salts, or other hardening materials, the better the water is for the process of wool-washing. Such waters come from strata consisting of the older rocks, which contain their bases in the form of silicates, little acted on or dissolved by water.

"In England and the Lowlands of Scotland we find, as a general rule, that the strata lie in the order of their age, beginning with the west coast, where we find the older rocks, and that the later rocks crop up in succession of age as we proceed towards the east. Most of our large rivers and tributaries, with the exception of the Severn, flow eastwards, and we find the upper waters comparatively soft and pure, and hence more suitable for the purpose of wool-washing.

"The Severn, in its upper course, also flows eastward, and there its water is pure and soft, while, as its course curves first to the south and then to the south-west, it drains a country containing later strata—such as . . . . rocks readily acted on by water.

"In the Highlands of Scotland we have the older primitive rocks, gneiss, granite, &c., all consisting of insoluble silicates. Hence we have there pure, soft waters often as low as two degrees of hardness. We have similar waters in many parts of Wales, where Bala Lake and the upper waters of the Severn and Wye are also of a very low degree of hardness.

"The upper waters of the rivers of Yorkshire, which rise to the south of the limestone-district, are, though not so soft as the waters previously mentioned, still much more so than waters in other districts."

Within my own experience there is the fact that the Ripon and Thirsk district has the reputation, especially amongst foreigners, of producing from the same sheep wool of more than average quality; and it has been stated that when for the purposes of sale wool was sent in from just without this district, the fraud was immediately detected. The subtle causes of this supposed local superiority would well repay patient investigation.* The

* A practical neighbour, Mr. Frank Barroby, of Dishforth, near Thirsk, writes to me as follows:—"I may mention that I showed my wool in a class of nearly twenty exhibitors, at the Royal Agricultural Show at Leicester, the headquarters of the pure-bred Leicester, and had the first prize awarded to my wool. As to the superior quality of the Ripon district wool, I have heard the wool-dealers assign two reasons, each of which is very probable. One is that the sub-strata of red sandstone and freestone which underlie the greater part of this district act as a natural drainage, and the soil on these formations is invariably of a sound, and, in most cases, a good-bodied kind. The other reason assigned is, that the climate

late Mr. Torr,* whose opinion in many respects I regard as a student reverences the teaching of a consummate master, tells us this:—"On my own farm I can grow better wool on some portions than on others: in South Lincolnshire, about Spilsby, wool grows in an extraordinary manner: north of Fife, and south of the English Channel, the quality of the wool falls off; it then becomes hair or moss. The valuable fine lustre wool is pretty nearly confined to a few degrees of latitude; so that space being limited, there is little or no danger of wool ever glutting the market—fine lustre wool will ever bear a great value."

Valuable discoveries are made by attention to simple facts. The geological formation has a close relation to the nature of the soil, and the nature of the soil materially affects the quality of the wool grown upon it. Bakewell† classes wool-soils thus: Clay the best; next, sand; and then lime, or of that nature: the fellmonger knows well the effect of lime-water on skin-wool; it acts unfavourably on the fibre and gives it hardness: chalky soils make wool rough: the lime is said to act on the yolk, forming an imperfect soap, readily washed away: sand does not so combine. The particles of the soil, besides, have a chemical and mechanical action on the fleece; the wool becomes coloured: the colour is often indelibly fixed in the wool, a tint which remains after scouring. Also the nature of the soil is said to have an effect on the felting quality of the wool: we are told that Southdown wool grown on limestone does not felt well, but improves when the sheep is removed from that formation; but, at the same time, it is known that on the same soil different breeds vary in regard to the felting quality. I have much to ask the Professor of Applied Geology: to me the Ordnance and the Geological Surveys should be especially interesting: meanwhile I can only stay here to commend to the Professor the following illustration:—In the northern parts of Derbyshire, where the strata are abruptly broken, the difference of wool from the same kind of sheep was so marked and well known, that both by buyer and seller this language was quite understood—"My wool is grit, Sir; and I expect a better price than my neighbour's, which is limestone."

Meteorological Considerations.—In regard to "tempering the wind to the shorn lamb," the meteorological considerations affecting my subject are very important. The evidence before me tends

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is specially adapted to the growth of wool. I know that lambs, bought in the North and brought into the Ripon district, always produce wool much superior to that produced by the same class when grazed in their native climate." See p. 343.

* 'Journal,' New Series, vol. ii. p. 549.

† 'Observations on the Influence of Soil and Climate upon Wool.'—By Robert Bakewell. London, 1808.

to show that amongst the ablest agricultural minds there is a growing tendency towards shelter for the sheep, with a view to rendering climates more uniform: unsheltered fleeces are not so valuable as those better cared for: yolk may be washed away faster than it can be reproduced, as if shorn wool were exposed for a long time to the action of rain. Professor Wrightson's Vienna Reports in this 'Journal,' give us some idea of the Continental system, "Dry food and nightly shelter." Mr. Brown goes so far as to tell us that at home the day is coming when in winter lowland and upland sheep will be housed animals. In raising wool and mutton—and with the farmer of the United Kingdom proper these two considerations can never be dissociated—regard should be had not only to the rainfall generally, but to the mean local and monthly tables: in any country herbage and the well-doing of the flock does not depend on the annual rainfall, but on the even distribution of moisture, weekly and bi-weekly.* Mr. Torr has much to tell us on the subject of shelter, and he quotes his friend, Mr. Randell's, well-known experience and practice on clay-land, cheap thatched sheds on posts, filled in between with hurdles and straw, the sheep standing on burnt clay. Mr. Brereton uses sea-sand for this bedding purpose. In the 5th volume of the new series of the 'Journal' there is a valuable paper "On the Influence of Climate on Sheep," by Mr. Tanner. He tells us wool is materially influenced by climate and soil. Kempy † fleeces are in proportion to the rain and severity of the climate, and the poverty of soil; this injury may be checked by management; wool is better on some farms than on others more favourably situated. There are curious variations from wool to hair: independently of circumstances, there is nothing in the structure of a sheep to render it necessarily a wool-bearing animal: hair and wool are both produced from vascular bulbs beneath the skin: there is no essential difference whether wool or hair be produced.

Animal Physiology.—This introduces us to the Animal Physiologist, who can tell us something, but I think should tell us a vast deal more. To old Mr. Youatt we are greatly indebted for really good work; but in my present direction little has been done since his day. Especially as regards wool there is a void in agricultural literature which should be closed by some comprehensive paper "On the Animal Physiology of the Sheep," indicative of all authorities on the subjects quoted. In the Austro-Hungarian Agricultural Colleges wool, as has been

* See further on this subject a good paper in the fourth volume of the new series of the 'Journal,' by Mr. Whitley, "The Climate of the British Isles."

† By Kempy wool is meant the presence of short white hairs at the roots of the staple, which never take the dye, and disfigure all goods into which they are introduced.

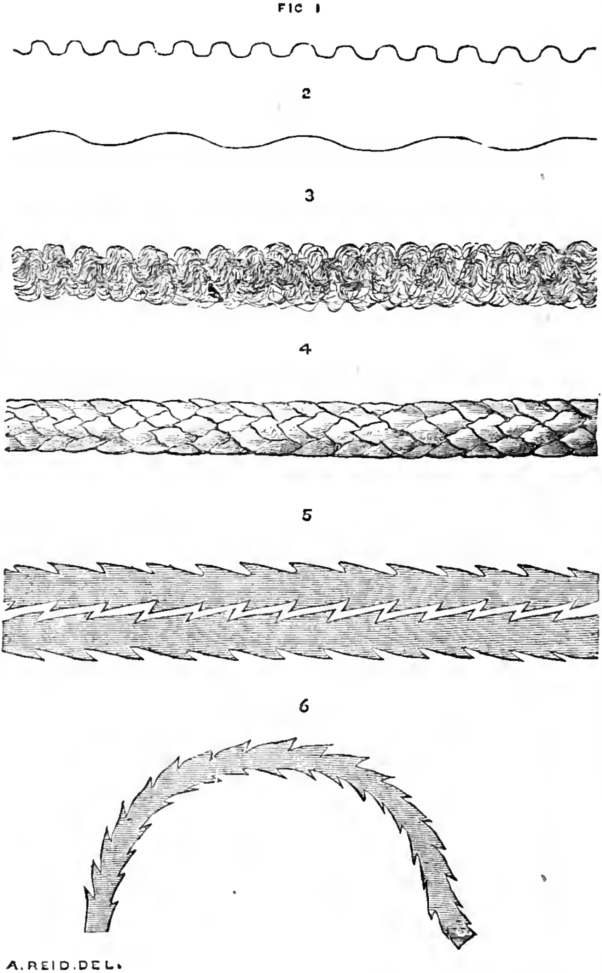
stated, is made a special branch of study: the nature and habits of the sheep require more study: little or no attention is given to the action of external causes on the unshorn fleece. It has been said that the fineness of the pile of wool is proportioned to the fineness of the skin-pores. Fleischmann states, in reference to the persistent endurance of a single cross, that the original coarse German sheep have 5500 fibres on a single inch; grades of the third or fourth merino cross produced about 8000; the twentieth cross 25,000; whilst the pure merino had 40,000 to 48,000; so that twenty crosses were not sufficient to make the race pure merinoes.* Wool is finer at the bottom of a full-grown staple than at the top: in short, there are any number of interesting lines of scientific inquiry. Hairy African sheep, with yolk all baked out, might improve by removal to more favourable influences. Here is a statement constantly cited, which cannot be explained physiologically, and from a scientific point of view it is scarcely creditable that the thing is not finally settled: If a lamb is suckled by a goat, the wool becomes hairy; a kid suckled by a ewe, the hair becomes woolly?

I beg the reader to give his best attention to the following description, with diagram, by Professor Archer, explaining the essential character of wool. For this I am specially indebted to Her Majesty's Commissioners for the London International Exhibition of 1871:—

"The essential characters of wool can only be learned by a very careful, and even a microscopic examination of the material. Most of the terrestrial mammals with hairy coats produce two kinds of hair. The first and most apparent is that which is usually called *hair*, the other which is generally shorter, and underlies the former, is called either *wool* or *fur*. *Hair* is almost invariably cylindrical, with a smooth surface, whereas *wool* and *fur* are covered with scales, and some kinds have a waved or otherwise varied outline. The scales are of the utmost importance, and upon their number in a given space depends, in a great measure, the quality of the material. But besides being scaly, as shown in Fig. 4, wool from the sheep is also waved, as shown in Figs. 1 and 2, and in Fig. 3, the two former representing a single fibre of short and of long staple wool, the other a small lock of wool. Now it is attempted to show in Fig. 6 that the scales on each fibre are only attached by their bases, so that if we bend one, its scales are lifted up and project, their points, however, being all in the same direction. And it is further intended by Fig. 5 to show that if two fibres are brought side by side in opposite directions, the scales of one will catch in those of the other, and if we encourage this by mechanical means the result will be such an interlocking as will not easily be disconnected. Moisture will facilitate this combination very much, so that if a handful of wool be wetted and rubbed or beaten, the fibres will work into one another and form a compact mass. Upon this quality depends the shrinkage of flannels and other woollen goods when washed, and also the process called *felting*. The waviness of the fibres, too, enables them to remain intertwined when they have been spun into threads, and is, conse-

* See 'Spooner on the Sheep.' London, 1874.

sequently, a very important quality; for if we take fibres which lack this property, and twist them, if they possess any elasticity they will not remain twisted, not having any hold upon each other. Human hair will illustrate this.



"These structural peculiarities of wool are found to be so permanent, that hardly any amount of wear will injure them; hence it is found that woollen clothing reduced to the veriest rags may be torn up and its fibres separated into the state of wool again, and then recarded and spun into yarns for the weaving of excellent cloths. The discovery of this fact during the present century has added very much to our national wealth, by the prevention of waste and the creation of a new class of manufactures."

But here I am bound to say that Youatt's "Serration as

affecting Felting Theory," really first suggested by M. Monge,* is opposed by those who attribute this remarkable property to the yolk (sebaceous secretion): the practical Bakewell tells us that "cotted-wool" is where, from adverse causes, yolk ceases, and wool partially felts on the sheep's back. On the whole, upon the evidence, I incline to the opinion of Professor Brown,† who, amongst other replies, has kindly favoured me with the following observation:—"The essential character of the felting property has not yet been determined; neither serration nor the presence of yolk sufficiently explains it." There can be little doubt that the invaluable English long wool has deteriorated; what it has gained in quantity it has lost in quality.‡ It has been said that a fine open winter produces more wool than a severe one, but the wool is coarser. Flush of food increases quantity at the expense of quality: naturally too rapid growth is inconsistent with perfection—true uniform fibre from root to point—elastic, not easily broken, with shining silvery lustre—and, above all, of great density. The famous Mr. Bakewell, of Dishley, said, to grow fine wools on rich pastures you must overstock them. Disease, a want of food and warmth, causes the secretion of the wool-forming fluid to cease, making a jointed staple which breaks where the stoppage took place. It would appear there is a general impression we have too much indiscriminate breeding—too much uncertainty in regard to food and treatment—and both at home and in the Colonies there would appear to be many ideas and opinions all converging towards the establishment of sheep studbooks.

Before conducting the Animal Physiologist for the purpose of consultation with the chemist, especially in regard to yolk, its uses and properties, perhaps the most practically interesting point in my scientific inquiry, I have a word to say in regard to that all-important scientific instrument, the improved microscope. What may not be done for us by the combined use of the photo-electric microscope,§ photography, micrometer measurements, and the other scientific great guns with which science now batters down ignorance and prejudice? Old Mr. Youatt, to whom we are so much indebted for important investigations in this direction, confidently expected that advances in optical science would certainly lead to further discoveries. Mr. Bakewell also pointed to a fine field for microscopical investigation, which field has not hitherto, so far as I am advised,

* M. Monge ('Ann. de Chymie,' tom. vi. p. 300). The felting of wool is an effect resulting from the external conformation of the several fibres which have lying one over the other from head to tail scales like those of a fish.

† Professor of Physiology, Royal Veterinary College. I have had a kind offer of assistance from Professor Brown. He would apply the most recent optical apparatus to the study of particular specimens of wool.

‡ See note, page 318.

§ Ganot's 'Physics,' Atkinson's edition, 1873, p. 488.

been satisfactorily explored. Let us, under the microscope, compare and fix the images of various wools of known properties, and so "mark, learn, and inwardly digest" the characteristic and essential differences of structure, upon which depend their respective economic values.

Chemistry.—Dr. Voelcker, whose kindness is proportioned to his abounding stores of available knowledge, has favoured me with the following interesting communication on the chemistry of wool:—

"39, Argyll Road, Kensington, W.
"February 5th, 1875.

"MY LORD,—The most recent investigations on the chemical constitution of wool I find were made a year or two ago in Germany by M. Märker and E. Schulz.

"Raw sheep's wool contains:—

1. Hygroscopic water (moisture).
2. Fatty matters.
3. Yolk of wool (fatty acids combined with potash, and soluble in water and partly also in alcohol).
4. Pure wool-fibre.
5. Dirt.

"The relative proportions of these constituents vary greatly in different species of wool.

"According to Märker and E. Schulz's analyses, raw wool yields from 42 to 50 per cent. pure wool-fibre (dried at 212° Fahr.), 10 to 18 per cent. of moisture, 7 to 10 per cent. of fatty matter, 20 to 22 per cent. of yolk (soluble in water), and variable proportions of dirt.

"The portion soluble in water (yolk) amounting to 20 to 22 per cent. contains fatty acids—oleic and similar fatty acids—combined chiefly with potash and a small proportion of nitrogenous organic matter. The watery solution, or the washings of wool with water evaporated to dryness, yields an extract which consists of:—

Organic matter, chiefly fatty compounds, containing nitrogen (1·82)	58·92
Mineral matter (ash)	41·08
	100·00

"The mineral portion (ash) of this extract yields from 59 to 84 per cent. of potash.

"In some places the potash is recovered technically from these wool-washings.

"In an air-dry state raw wool contains about 8½ per cent. of mineral matter (ash), which is removed by washing. Washed wool (wool deprived of the yolk by washing in water) seldom contains more than 1 per cent. of mineral matter (ash).

"Pure wool (fibre) dried at 212° Fahr. consists of:—

Carbon	49·25
Hydrogen	7·57
Nitrogen	15·86
Sulphur	3·66
Oxygen	23·66
	100·00

"It will be seen that wool not only is rich in nitrogen, but also contains a

considerable proportion of sulphur. E. Schulz further has shown that the portion of the yolk of wool, which is soluble in alcohol, consists principally of cholesterin, a peculiar well-defined fat.

"Raw sheep's wool was also analysed in 1866 by Dr. Edward Heiden, who gives as its composition:—

Moisture	10·443
Fatty matters	27·018
Mineral matter (ash)	1·028
Sand	1·914
Pure wool-fibre	59·597
	100·000

or in a more detailed form the composition of raw wool is given by Dr. Heiden as follows:—

100 parts contain:—

Moisture	10·443
Fatty matters	27·018
Pure wool	59·597
Oxide of iron	·181
Lime	·246
Magnesia	·060
Potash	·191
Soda	·027
Chlorine	·008
Carbonic acid	·031
Phosphoric acid	·031
Silicic acid	·253
Sand	1·914
	100·000

"It appears from Messrs. Märker's and Schulz's researches that raw wool contains both oil or fat in a free state, and fatty matters chiefly in combination with potash, forming a kind of soluble soap, which explains the loss in weight which wool sustains by the removal of the greater part of the fatty matter of raw wool.

"Believe me, my Lord, yours faithfully,
"AUGUSTUS VOELCKER.

"Right Hon. EARL CATHCART."

The Yolk.—The quality of the wool is said to depend on the yolk; hence the interest of the preceding information and of all investigations regarding its properties and effects. I should be glad to know chemically the essential difference between yolk and tallow: until now the subject has been neglected, and previously to my application to Dr. Voelcker, I knew not where to find any reliable chemical facts. All I could discover was that yolk is a soap of potash,* and compounds of potash with lime and animal matter, that imparts to wool its characteristic odour. The saturation with yolk gives wool the silvery lustre so much desired: how far can art supply this copious secretion, and what are the

* Sheep are often washed in running-water, so that the valuable scouring properties of the yolk are lost. The greasier the water the whiter the wool.—*Mr. Turner.* See note, page 346.

effects on it of extremes of heat and cold? This also is known, that the free secretion of yolk gives that most desirable quality in wool—density. In washing, wool loses about one-third* of its weight—at least, from one-third to half weight is deducted when, unwashed on the sheep's back, wool is bought—called wool-in-grease. When the wool is washed on the sheep's back, the soap of yolk is of course dissolved, and takes the salts along with it. M. Raspail estimates that the grease from French wool-washing would manure 370,000 acres. On the Continent, potash, which Dr. Voelcker somewhere puts at $1\frac{1}{2}d.$ a pound, is in wool-washing and scouring operations carefully saved. The 1871 experience, in the words of the Report, teaches us—

In reference to our 'wool-scouring.' The best labour-saving machine we possess, up to a certain stage, is undoubtedly the machine of Mr. Petrie; but we still need an improved apparatus, amply supplied with water for washing off the suds, so as to rid the wool entirely from all unctuous matter before it is dried.

"Let not our manufacturers, therefore, be taken unawares, if a couple of intelligent Continental wool-scourers, technically educated in chemistry, be presently found located within a few hundred yards of Mr. Petrie's works, introducing a new process of scouring altogether (as regards the chemicals used), yet in connection with Mr. Petrie's machines; employing, after his squeezing rollers, a 'washing-off' apparatus from the Continent, to complete this important operation.

"It is also not improbable that instead of the usual alkali an ingredient will be used which can be reclaimed or distilled from the 'suds' by a small *still*, so as to be used over and over again. This, too, in addition to the reclamation of grease from the sud."

Mr. Fairley, the Yorkshire consulting chemist, who, from residence at Leeds, is peculiarly qualified, has favoured me with the following practical note:—

"The process of wool-washing, or rather *scouring*, in Leeds and similar districts, is essentially a different process from that on the sheep-back of wool-washing by the wool-grower. The materials used for the 'scour' are lant (stale urine) and soap; or lately, in place of the latter, soda-ash. This crude but powerful alkali must be used with the greatest care, as the slightest excess seriously injures the wool. The scouring is either done by hand or by the aid of the patent wool-scouring machine (Petrie's and other combined patents). The wool-scouring is simply the first stage in the manufacture of wool into cloth.

"In wool-washing, wherever practicable, the rain should be collected from the roofs of the farm-buildings, &c., and utilised. If the washing were performed with successive small quantities of water in vats, &c., through which the sheep could be passed successively, the minimum quantity of water would suffice; and the valuable potash now wasted, which forms, reckoned, as carbonate from 7 to 8 per cent. of the raw wool. This potash is abstracted from the soil, and ought to be returned to it in a perfect system of wool-growing." †

From the point of view of one of the most celebrated ram-breeders in England, a professional farmer of great culture and

* See page 334, note. See also *Chemistry*, page 326. It seems clear that the grower who sells wool-in-grease is unthrifty.

† See the late Mr. Torr's practice, page 345.

experience, yolk is simply the insensible perspiration which diffuses itself over the wool. It is more, but how much more is not accurately known; Mr. Bakewell suggests that, by some unknown process, the secretion in part forms the fibre or filament: or is it a mere lubricant, as oil lubricates leather? Mr. Youatt observes: "There is most yolk about the neck and breast, and there is the best wool; softness of pile and yolk go together." Mr. Bakewell further dwells on the bad effects of heat on wool growth, and on the analogy of wool, hair, feathers, and the viscous fluid, the secretion of the silkworm and the spider, and the possible action of the absorption of oxygen near the surface of the skin. I am, however, by authority physiologically advised that the chief object of yolk is simply to keep the skin soft and pliable, and incidentally to keep the hair or wool in an elastic condition. Upon the evidence, then, taken as a whole, I in this day quite concur in Mr. Youatt's conclusion; the great practical question is, in addition to care in breeding, how to promote the growth of yolk? Mr. Youatt says, on yolk farmers never bestow a thought, and neither understand nor care about it; this question, without doubt, will some day be regarded as one of the very cardinal and essential points of the sheep.

We must hasten through the wool-room * to speak a word to the agricultural engineer. The cloths to prevent undue evaporation of yolk, the darkness to maintain the bright lustre, the damp that causes wool to "clag together," and the yellow mould, are all well known; we would also gladly, were it possible, squash once and for ever the wool-moth, *Tinea sarcitella*.

Mechanics.—Great things have been done for agriculture by our mechanically scientific agricultural engineers. Machinery has been constructed by which a pound of wool has been spun out to the incredible distance of $95\frac{1}{2}$ miles; why do not our engineers a little regard the wool whilst still on the sheep's back? Here is such a picture for a painter, but not for the student of economic science—the frightened sheep, the rheumatic shepherd up to his middle in the dirty hard water, the muddy banks, the intonations of the ewes and the responses of the lambs, the long and dusty road home, full of unwilling sheep, all aggravated by the inevitable barking and frisking of the "officious dog." Clipping on a dirty skin makes rough work. By the way, in these days of labour difficulties, are we to have patent shears, on sound mechanical principles, some adapted for power, others for unskilled labour? Some close pile-wool cannot, in the usual way, be washed at all. The importance of the inverted position of the sheep—the sheep on its back—is much and properly insisted

* It is observed in the wool trade that the farmer is most willing to force his wool on the market when prices are low, fearing further flatness. With high prices he holds for a rise.

upon; it is most favourable for the rapid falling away of earthy matter.* Swedish sheep are always washed on their backs; tub-washing—they say that they cannot cleanse if they brook-wash. Spout-washing,† 5 or 6 feet fall, has long been practised in Germany: first on head and shoulders, then on belly, the sheep is reversed, lastly, on back; the sheep is first soaped in a trough, and all this done at a cost, per head, of one penny. Those who visited the London International Exhibition of 1871 may remember the apparatus for washing wool on the sheep, and also that for sheep-shearing, both on a grand scale. The principal features of the complete apparatus for steam-power sheep-washing, now used by some of the greatest wool-growers in the world, are shortly these: a rain-yard, hot-water tank, swimming-tank, and lastly, for finishing off, a cage of tubes, with inner and all-round perforations, which squirt converging jets of water upon the centrally-placed sheep. I am charmed to find that, quite independently, the well-known engineering firm, Messrs. Gwynne, the eminent exhibitors in question, are travelling with me by a road of their own towards the same longed-for destination; I need only add, in addition to their obliging communication which follows, that it is to be hoped that they, with many of my readers and myself, may meet together in the show-yard at Taunton:—

"We have at present in prospect an entirely new operation for purifying wool, which will enable us to cleanse it thoroughly from all impurities, and make it fit for the market at a merely nominal cost; or, in other words, that the waste product we derive from the washing of the wool will more than pay the cost of washing."

Statistics.—A chapter on the political economy now involved would be interesting, but with a very few words we must pass on to its essential statistical handmaiden. We see in imagination the finger of the Editor good-naturedly uplifted to warn us, that in the 'Journal,' as in this old and populous country, all available space must be carefully husbanded. The food of the people in England is the English farmer's chief consideration: trans-oceanic competition is even fast driving the Continental farmer from the wool to the carcass: yet it must ever be remembered that the means of obtaining food depends on industrial employment: nearly the greatest of English industries depends on wool, a cultivated article regularly cropped. The question of wool supply can never be disregarded, especially the supply of the invaluable English long wool so useful in assisting to work

* See Mr. Cox's sketch, page 341.

† In a pleasant note, which is much like the writer, my colleague, Mr. Milward, tells me spout-washing was established at Thurgarton at the end of the last century, and in combination with a wooden T-like instrument, to work the sheep's back, the practice has since been advantageously continued.

up other kindred raw material. We can never disregard the importance of our great staple manufactures which so advantageously act and re-act on agriculture. It is interesting to observe that the wool manufacture, the spoilt child of English legislation, was never thoroughly happy and prosperous until it was left free to run alone and unaided: that freedom in the Colonies, in which we are all personally or relatively interested, induces practical men to expend, without hesitation, 6000*l.* in a single sheep-wash pool and its plant. We of the Royal Agricultural Society rejoice in the much-to-be-desired spirit of unity and co-operation which has promoted such Societies as that recently established in New South Wales,* and which promises valuable periodical contributions to agricultural literature. The political economist and student of history may further reflect upon the diversion of the stream of commercial transport, which was long ago revolutionised by maritime discovery and the mariner's compass, and is now again returning to its ancient channels by Alexandria, the Suez Canal, and the narrow seas.

The 'Journal' of the Statistical Society contains in the Quarterly number, published in December 1870, a valuable paper by Mr. Hamilton "On Wool Supply." Unfortunately, unlike the statesman, the merchant, and the manufacturer, the English farmer, perhaps from the want of an organised educational system, does not, as a rule, duly appreciate the value of statistics: it is quite otherwise in Scotland and in America; in the Report of the United States Commissioner of Agriculture for 1871, we find that the statistician of the department occupies with interesting and suggestive matter some 60 large pages. Tub-washed wool is a regular quotation. In 11 years, 1861–71, United States sheep increased from $21\frac{1}{2}$ millions to 32 millions; home-grown wool from 55 millions of lbs. to 128 millions: this disproportionate rate of increase in wool is attributed to care in breeding. The average fleece in 1850, 2·42 lbs.; 1860, 2·73 lbs.; 1870, 3·51. For the average weight of the English fleece, see the most interesting estimate compared by me with various authorities, and which follows: "Estimate of British Home-Grown Wool." †

Before arranging the statistics of my subject in the manner which I hope my readers will find most convenient and instructive, I would make one or two extracts from Mr. Hamilton's statistical paper. The importation of

	Per cent.		Per cent.
Flax in 30 years has increased	25·	Cotton in 30 years has increased	110·
Silk ,, ,, ,,	59·	Wool ,, ,, ,,	349·

* I beg to thank Captain Jopp, of the N. S. W. Government Office in London, for ready assistance.

† See pp. 333 and 334.

He says, speaking of the weights of English fleeces:—

"Mr. Luccock in the year 1800 published a detailed estimate of the weights of fleeces, which was revised in 1828 by Mr. Hubbard, and again in 1840. In 1851, Mr. Thomas Southey, after extensive inquiries, took the average for the United Kingdom at five pounds.

"Since the earlier of those dates, considerable changes have taken place in the actual weights of fleece, owing to improved breeding: and even during the last twenty years this has been the case with the sheep bred in agricultural districts, though not so much with those bred on pasture-lands. The weights, moreover, are considered to vary from year to year as much as from a quarter to half a pound per fleece, according to the seasons and breed.

"I am indebted to Mr. Legg, of Bermondsey, and Messrs. J. and J. Hubbard, of Bradford, for much important information on this subject; and the latter gentlemen write, that 'in all the counties suitable for the heavier class of sheep, the weight of fleece has very considerably increased during the last twenty years, it having been found to the profit of the grower to cross with Leicester, &c., sheep, both as regards the wool and the mutton. A considerable buyer of wools in Cambridgeshire writes us, that "the weight of wools grown in that district has doubled or almost trebled during the fifty years I have been a buyer, not only as regards the number of sheep kept, but the weight of fleece."'

Mr. Hamilton remarks, and this is very noteworthy, fluctuations in the prices of Colonial wool depend not so much on supplies as upon variations in demand, owing to commercial vicissitudes and political circumstances.

The intelligent agricultural mind will probably most readily assimilate the essential statistical details of my present subject, when stated in the method which follows.

Table I. shows the persons in England employed in working up the raw material:—

TABLE I.—From Census, 1871.

Employed in Wool Trade.	Total of both Sexes.	Males.	Females.
Woollen Cloth Manufacture ..	128,464	71,683	56,781
Woolstapler	1,964	1,957	7
Wool, Woollen,—Dyer	2,606	2,603	3
Wool and Worsted, others working and dealing in	40	11	29
Worsted Manufacture	94,766	34,053	60,713
	227,840		

Tables II., III., and IV. respectively show the home and imported wool manufactured in England, and the countries from which imported:—

TABLE II.

stimate of Home-Grown Wool, taking the Average Returns of Sheep One Year old and above, for the Years 1867–69, and the Weights of Fleece as supplied by Messrs. J. and J. Hubbard, of Bradford.

Counties.	Sheep.	Weight of Fleece.	Pounds of Wool. [000's omitted.]	Memoranda.
		lbs.		
edford .. .. .. / erks .. .. .. / uckingham	564,344	6	3,386,	
ambridge	215,454	6	1,293,	Half-breds, 6 to 7 lbs. Leicesters, 7 „ 8 „ Downs, 4 „ 4½ „ All grown in this county.
hester	124,332	4	497,	
ornwall	265,702	7½	1,993,	These are unwashed.
umberland	350,622	5	1,753,	Several breeds grown here.
erby	164,480	5¼	864,	
evon	592,157	7½	4,441,	These are unwashed.
orset	344,211	4¾	1,635,	Horns, 5½ lbs. Downs, 3½ .. Both sorts grown.
urham	140,900	4	564,	
ssex	312,945	5	1,565,	Kents and half-breds, 5 to 6 lbs. Downs .. .. .. 3 „ 4 „ Both these breeds grown in this county.
loucester	296,803	7	2,078,	This is the regular large breed.
Hants	406,649	6	2,440,	
Hereford	226,773	5½	1,247,	
Hertford	142,771	5	714,	Half-breds, 5 to 6 lbs. Downs, 4 „ 4½ „ Both breeds grown in this county.
Huntingdon	100,606	6¾	679,	
Kent	721,517	6	4,329,	
Lancaster	197,960	5½	1,089,	
Leicester	297,435	6¾	2,008,	
Lincoln	1,005,340	8	8,043,	
Middlesex	34,802	5	174,	Half-breds, 5½ to 7 lbs. Downs, 4 „ 4½ „ There is no regular breed peculiar to this county.
Monmouth	132,108	2½	330,	A light Welsh class of sheep.

TABLE II.—ESTIMATE of HOME-GROWN WOOL, &c.—*continued.*

COUNTIES.	Sheep.	Weight of Fleece.	Pounds of Wool. [000's omitted.]	MEMORANDA.
		lbs.		
Norfolk	480,511	4	1,922,	Half-breds, 5 lbs. Downs, 3 lbs. to 4 lbs. Both sorts grown.
Northampton	363,519	6	2,181,	
Northumberland ..	572,764	6	3,937,	
Nottingham	189,914	$6\frac{1}{4}$	1,187,	Deep staple and bright hair.
Oxford	229,916	$5\frac{1}{2}$	1,265,	
Rutland	70,262	7	492,	
Salop	306,295	$5\frac{1}{2}$	1,685,	
Somerset	521,675	7	3,652,	
Stafford	207,860	$5\frac{3}{4}$	1,195,	
Suffolk	317,628	$4\frac{3}{4}$	1,509,	Half-breds, 6 lbs. Downs, 4 to $5\frac{1}{2}$ „ Both sorts grown.
Surrey	87,694	4	351,	
Sussex	379,064	4	1,516,	
Warwick	251,676	$5\frac{3}{4}$	1,447,	
Westmoreland ..	218,416	5	1,092,	Several breeds grown.
Wilts	473,237	$3\frac{1}{2}$	1,656,	Downs.
Worcester	166,281	$5\frac{1}{2}$	915,	
York, E. Riding ..	320,225	$8\frac{1}{2}$	2,722,	Deep staple and bright hair.
„ N. Riding ..	437,561	$5\frac{3}{4}$	2,516,	Masham, 5 lbs. Scotch, 4 to $4\frac{1}{2}$ „ These also grown here.
„ W. Riding ..	476,613	$5\frac{3}{4}$	2,740,	Deep staple and bright hair.
Wales	1,733,078	$4\frac{3}{4}$	8,232,	General average, as per Mr Bottomley's estimate, October, 1870.
Total	14,442,100	..	83,334,	
Ireland	3,098,947	6	18,594,	
Scotland	4,605,315	$4\frac{3}{4}$	21,875,	General average, as per Mr Bottomley's estimate, October, 1870.
Isle of Man and Channel Islands	43,442	about 5	217,	
Total in United Kingdom ..	22,189,804	..	124,020,	

Note.—Allowance should be made in all wools unwashed, or in the grease, of one-third in weight for clean wool.

This comprehensive Table can of course at any time be made to fit the Agricultural Statistics of the day by a simple Rule-of-Three process.—C.

TABLE III.

IMPORTS of WOOL, WOOLLEN MANUFACTURES, YARN, &c., into and from GREAT BRITAIN (according to the Board of Trade Returns) during

	1874.	1873.	Average 1869-1873.
	lbs.	lbs.	lbs.
nports of Wool from Australia	225,426,101	186,281,953	175,172,272
,, ,, ,, Cape of Good Hope	42,015,777	42,332,062	35,575,168
,, ,, ,, British India.. ..	19,099,273	19,265,145	17,423,811
,, ,, ,, European Countries	34,758,391	34,380,693	35,685,683
,, ,, ,, Other Countries ..	17,500,939	30,801,391	26,144,220
otal Imports of Foreign and Colonial Wool	338,800,481	313,061,244	290,001,154
,, Exports ,, ,, ,,	144,362,359	123,236,636	120,994,041
eaving for Home consumption	194,438,122	189,824,608	169,007,113
nports of Alpaca, Vicuña, and Llama ..	4,186,381	4,422,181	3,807,497
,, Goats' Hair	8,013,706	6,297,447	5,805,926
nports of Woolleu Rags torn up or not, to be used as Wool	57,361,920	55,888,000	49,818,810

TABLE IV.

IMPORTATION of COLONIAL and FOREIGN WOOL into the UNITED KINGDOM, 1865 and 1874.*

	1865.	1874.
New South Wales and Queensland	79,672	136,748
Victoria	135,513	265,417
Tasmania	16,082	17,223
South Australia	45,505	85,590
West Australia	2,991	6,285
New Zealand	52,797	140,313
Australasian	332,560	651,576
Cape	99,991	164,194
Colonial	432,551	815,770
German	24,696	35,003
Spanish and Portuguese	13,561	8,640
East Indian and Persian	54,228	63,291
Russian	37,147	32,570
River Plate	14,636	11,373
Peru, Lima, and Chili	46,338	36,661
Alpaca	23,653	35,095
Mediterranean and African	20,748	33,857
Mohair	27,441	47,551
Sundry	18,676	19,493
Total bales	713,075	1,139,304

* For several of these Tables I am indebted to Messrs. Helmuth, Schwartze and Co., Wool-Brokers, of Moorgate Street.

The rise and progress of these imports may be gathered from the following facts. I find the first importation of wool from Australia and New Zealand quoted in

1814	. . .	33,000 lbs.
1838	. . .	7,837,000 lbs.
1869	. . .	158,478,000 lbs.

1838 was the year of the formation of the Royal Agricultural Society. In regard to Australian progress, the 'Melbourne Argus' has compiled a short statistical account of the Australian colonies, made up to the close of the year 1873, showing their relative position and aggregate importance. An account of the live stock shows that the number of sheep in the colony of Victoria, in 1873, was 11,323,080; in New South Wales, 10,928,590; in South Australia, 5,617,419; in Tasmania, 1,490,738; in Western Australia, 748,536; in Queensland (in 1872), 6,687,907: making a total of 45,796,270 in the six colonies. Adding 9,700,629, the number in New Zealand in February, 1871, we have a total of 55,496,899 sheep in Australasia—a number larger probably than any other country in the world can boast.*

The 'Times' of January 4th last contains a letter from its correspondent in New South Wales, who says:—"Our production of wool is likely to be much larger proportionally in the next twenty years than it has been for the last, as our squatters have been expending their energies (and their splendid profits for the last three years also) in fencing in their runs, securing good blocks of country as freeholds, and building dams to secure permanent water. Also there is much more attention being paid to 'breed' than previously, and the squadrons (?) of half-wild 'jinnbucks,' with their ragged 2 lb. fleeces, are growing into quiet flocks of double the weight and quadruple the value."

Table V. (p. 337) shows the relative values, per lb., of home and imported wool. It gives the value in pence, per lb., of several representative descriptions of wool on the 1st of January of the past ten years:—

Table VI. (p. 337), for which I am much indebted, is specially prepared by the Bradford Chamber of Commerce to show the yearly average price of English wool, per tod, from 1812 to 1873 inclusive.

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* I should not forget McArthur—that national benefactor—that wonderful Captain of Infantry—who in 1791 founded the sheep husbandry which is the source of Australian prosperity. See his own official statement, 'Bischoff,' vol. i. p. 366.

TABLE V.

Value on the 1st Jan.	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.
Wool:—	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*
Lincoln Hogg Fleeces ..	29	24	17	20½	19¾	18	27½	28	26	23½
East India, ordinary yellow	10¼	7¼	7½	8	6½	7¾	9¾	12	10	9½
Donskoi, average white fleece	12½	11	8	9	8½	9½	14½	13½	10	10½
Peru, middling	17	15	10	10½	9½	10¾	16	15½	14	14
Buenos Ayres, fair Mestizo grease	9	8	6¼	5¾	5½	5¼	8¼	7¾	7	7½
Australian, average fleece washed	24½	22½	20½	19½	18	17½	25	27	25	23½
Cape, do. do.	17	15½	12½	12½	11½	11½	17½	18½	16	16½

TABLE VI.

Table shewing the Average Price per Tod (28½ lbs.) of Wool from 1812 to 1873.

Year.	Average Price. £	s.	d.	Year.	Average Price. £	s.	d.	Year.	Average Price. £	s.	d.
1812	1	5	0½	1833	1	6	9	1854	1	15	2
1813	1	10	8	1834	1	16	7	1855	1	6	6¼
1814	1	19	0	1835	2	4	3	1856	1	10	11
1815	2	4	5¼	1836	1	17	0	1857	1	16	5
1816	2	8	6	1837	2	1	2¼	1858	2	0	6¼
1817	1	11	1½	1838	1	10	2	1859	1	13	7¼
1818	1	15	3	1839	1	17	10	1860	1	19	9¼
1819	2	12	0¾	1840	1	12	7¼	1861	2	5	4
1820	1	16	7	1841	1	8	1	1862	1	18	0¼
1821	1	14	2½	1842	1	4	6	1863	2	3	0½
1822	1	1	1½	1843	1	2	8¼	1864	2	10	11¼
1823	1	4	8½	1844	1	4	4	1865	3	0	6
1824	1	5	10	1845	1	9	2	1866	2	17	0¼
1825	1	10	2½	1846	1	9	10	1867	2	6	6
1826	1	16	6	1847	1	7	0	1868	1	17	5¾
1827	1	4	8	1848	1	3	10	1869	1	18	3¾
1828	1	2	10	1849	1	0	1	1870	1	15	9½
1829	1	0	6	1850	1	1	9	1871	1	14	9¼
1830	0	18	4	1851	1	6	2	1872	2	5	6½
1831	1	4	0	1852	1	7	0	1873	2	15	8¾
1832	1	7	6	1853	1	9	1				

Having gone thus far, I have now only to consider the British exports of raw and manufactured wool not consumed in this country, and the places abroad to which exported, Table VII. (p. 338).

It is so very important, I feel constrained to add Table VIII. (p. 339), Mr. Hamilton's estimate of the wool supply of the world. He says:—"In conclusion, I will attempt to estimate the entire supply of wool available for the consumption of Europe and America, because, as soon as the latter sees fit to adopt free trade in wool, all manufacturing countries will have a common interest

in the supply, and all will benefit by the free importation and free interchange of the numerous descriptions of wool.

"I base the following estimate (Table VIII.) on the numbers of sheep given in the 'Agricultural Returns' for 1869, though the estimate will readily be understood to be merely an approximation."

TABLE VII.

EXPORTS OF WOOL AND WOOLLEN MANUFACTURES, YARN, &c.

	1874.	1873.	Average 1869-1873.
Exports of Domestic Wool—	£	£	£
To Germany	3,016,955	2,803,794	1,994,054
,, Belgium	1,359,484	1,195,313	1,445,831
,, France	3,077,167	1,322,509	2,636,361
,, United States	930,733	820,974	2,370,076
,, other Countries	1,662,994	892,145	1,175,437
Total Exports of Domestic Wool ..	10,047,333	7,034,735	9,621,759
Total Exports of Woollen and Worsted Manufactures	22,794,977	25,349,878	25,849,944
Total Imports	4,022,669	3,840,096	3,720,481
Excess of Exports over Imports	18,772,308	21,509,782	22,129,463
Total Exports of Woollen and Worsted Yarns	5,558,963	5,393,493	5,627,380
Total Imports	1,492,715	1,495,343	1,433,320
Excess of Exports over Imports	4,066,248	3,898,150	4,194,060
Exports of Woollen and Worsted Manufactures and Yarns—			
To Germany	6,008,771	6,482,465	9,060,321
,, France	3,876,865	3,587,763	3,242,005
,, United States	4,695,478	5,945,818	5,320,567

In now taking leave of the statistical branch of my subject, I cannot too strongly enforce this consideration, that if it is desired to forecast the future, we must diligently study the tendencies of the familiar lines in which the past has run, and then, with the necessary deviations, let imagination boldly project these lines into unknown space.

The Flocks of the World.—I am now to make a rapid practical tour of the wool-growing districts—the sheep-walks of the world. Leaving Iceland, where crossing with English sheep has done much, I traverse the Atlantic to scamper round the Americas: in Canada I find neglected Leicesters and a want of new blood: in California they say they can raise any breed, but now produce

TABLE VIII.

Countries.	Date of Returns.	[000's omitted.] Sheep and Lambs.	Weight.	Value.	Memoranda.
			lbs.	£	
United Kingdom ..	1867–70	Average 34,138,	159,969,	7,998,	
Australia	1868	37,441,	152,200,	11,356,	Grease allowed for.
Tasmania	1868	1,742,	6,136,	474,	10 per ct. grease.
New Zealand ..	1868	8,418,	28,875,	1,564,	60 ,,
Cape of Good Hope and Natal	1865	10,001,	38,001,	2,533,	15 ,,
River Plate	1863	Unknown	138,070,	3,452,	Grease—Exports.
East India	1869	,,	18,797,	627,	Imports to United Kingdom.
Russia	1859-63	45,330,	90,760,	3,777,	
Sweden	1867	1,622,	6,082,	228,	Imports to United Kingdom trifling.
Norway	1865	1,705,	6,395,	225,	
Denmark	1866	1,875,	7,031,	322,	
North Germany, Wurtemburg, and Bavaria	1863,'66, and '67	25,251,	52,080,	4,340,	
Holland	1867	1,027,	6,163,	231,	
Belgium	1856	583,	3,500,	131,	
France	1866	30,386,	91,158,	3,408,	Grease.
Spain	1865	22,055,	74,433,	6,202,	,,
Italy	1867	11,040,	24,840,	1,035,	No Imports to United Kingdom.
Austria	1864	16,573,	31,075,	2,331,	Very trifling Imports.
Switzerland	1866	445,	1,336,	50,	No Imports to United Kingdom.
Greece	1867	2,540,	7,618,	222,	
United States* ..	1867	32,796,	177,000,	14,105,	{$75,225,000 currency.
			1,121,519,	64,611,	

Note.—Allowance for lambs and skins used in Russia, one-third the number of sheep; and for lambs in other countries one-fourth the number of sheep.

only mongrels: running down the Pacific to Peru, I may note with pleasure great improvement: rounding Cape Horn, I come to the River Plate, and complain of short weak staple, bad washing and worse packing, a want of English rams. Returning by the

* Mr. Wells's Report, 1869.

usual track to Lisbon, I find flocks requiring attention as regards breed and management. Making a circuit of Europe, I see that the splendid Dutch wool might be improved by crossing and by better washing; the Flemish wool requires also attention in washing, and freeing from straw and dirt: the Russian native sheep, Donskois, are capable of great improvement; the South-Russian Merinos are magnificent: the Austrian sheep, the Zackels, the Wallachians, and others, are being improved by English crosses, but attention is required in washing the wool: all contain the burrs which are so objectionable: Turkish sheep should be crossed with the Leicester; there is the basis for capital combing-wool—hitherto the wool has been scurvy and kempy. To circumnavigate Africa, at Mogador I find English blood required to cross, and more attention to washing and cleaning: at the Cape, Leicester and Lincolnshire sheep, in many districts, might be introduced with great advantage: much wool is now scoured and sent to London in good condition, known as a "snow-white" wool: Natal possesses great natural advantages; the amalgamating Leicester is wanted. Egyptian wool is apt to be spoilt by grey hairs, but the wool is soft, bright, and silky; it comes near many classes of English wool. Taking Persia and the East Indies on my way to China, I find improvement on the march towards a large field awaiting development: in the more temperate regions I find wool of long and sound staple. China, with its wonderfully reproductive sheep, promises by judicious crossing and cultivation great improvement. From China to Australia is plain sailing: Sydney, with room for improvement, I leave, to admire at Port Phillip* combing-wools more perfect than any in the world, and also the Leicester Merino: having lingered there, I go on to Adelaide, with parched sheep-runs; but the better flocks produce good combing-wool. In New Zealand I conclude my flying tour; that colony is well calculated to produce long-stapled wool; the large supplies now sent to London are very much in favour, but more care should be exercised in washing.†

Essentially practical and practically suggestive.—Mr. G. H. Cox, a member of the Legislative Council of New South Wales, an eminent agricultural authority there, has, on my suggestion, favoured the Royal Agricultural Society with the following description of his mode of spout-washing sheep. My best acknowledgments are due to this very able gentleman:—

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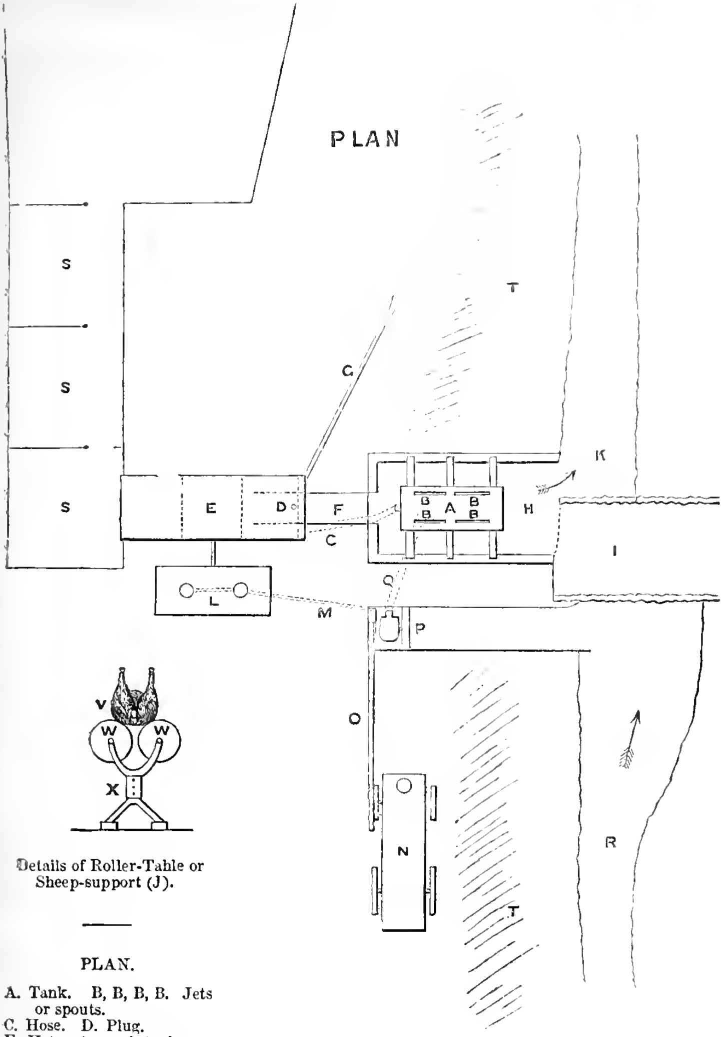
* The 'Pall Mall Gazette' of December 19th last, says:—"It is stated in Australian papers that a pure-bred Merino ram, owned by a Mr. Gibson, of Tasmania, and reared by him there, was sold in Melbourne a short time ago for the sum of 680 guineas. While the ram was in Mr. Gibson's possession the amount of money raised by the animal's male progeny alone was estimated at upwards of 5000 guineas.

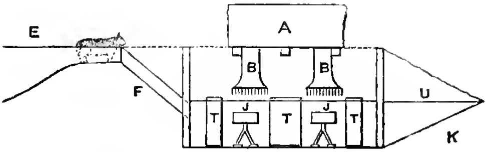
† Information received 1869. See further, the 'Vienna Reports' of 1873.



Details of Roller-Table or Sheep-support (J).

PLAN.

A. Tank. B, B, B, B. Jets or spouts.
C. Hose. D. Plug.
E. Hot-water soak-tank.
F. Slide.'
G. Drain to carry away dirty hot water.
H. Wash-pen.
I. Outlet for washed sheep.
K. Outlet for dirty water.
L. Boilers. M, M. Pipes.
N. Engine. O. Belt.
P. Pump. Q. Shoot.
R. Stream.
S, S, S, S. Sheep-pens.



ELEVATION

ELEVATION.

A. Tank supplied with centrifugal pump.
B. Four jets, 2 ft. 9 in. wide, ¼-in. orifice.
T. Tubs for men to stand in, 3 ft. 6 in. × 1 ft. 6 in.

J. Sheep supports (double rollers).
E. Hot-water soak-tank.
F. Slide. U. Water level.

SMALL ELEVATION.

V. Sheep on back. W, W. Rollers. X. Slide with key.

"The accompanying sketch of my wash-pen shows the position of all the parts, but the measurements are only approximate, as no actual scale was used in drawing it. There are four spouts, B, having an 8-feet pressure, 2 feet 9 inches wide, with an orifice of a quarter of an inch. The tank, A, above is supplied by a centrifugal pump, P, of 10 inches diameter, driven by an 8 horse-power engine, N.

"The hot water soak-tank, E, will hold twelve sheep, and is 15 ft. × 4 ft. × 3 ft. 6 in. deep, divided by sliding gates into three compartments. There is a grating at the end, D, and a slide, F, from it to the wash-pool or pen, H, a section of which is shown in the elevation.

"The wash-pen or pool, H, is bricked, and has an inclined plane at the outlet, K.

"A low dam is thrown across the bed of the stream, which raises the water, say 2 feet, and thus lessens the lift of the pump, which is fed by a drain or trench cut from the bed of the stream, R, into the tank, also bricked.

"The hot-water soak-tank, E, is fed by two boilers, L, of 400 gallons each, and these latter are filled by a small pipe, M, from the pump, P, the cold water required being obtained from the tank over the wash-pool by means of a hose, C.

"Now for the *modus operandi.*

"Twelve sheep are caught and thrown into the hot-water tank, E (making four in each compartment), which has previously been filled to within 6 inches of the top with water, heated to from 100° to 110° Fahrenheit, and in which also has been dissolved from 15 to 20 lbs. of soft-soap.

"The sheep then walk up an incline, or are lifted upon a grating at the end of the tank (see elevation), and after the fleece has been squeezed, are made to slide down an incline, F, into the hands of the washers (who stand in zinc tubs, T) and are placed upon the supports, J, immediately under the jets or spouts, B, where they are turned round and round until thoroughly cleansed; they then swim to the end of the pool and walk up an incline, K, to the top of the dam or causeway, after which they pass at I to the drying paddocks.

"The hot-water tank, E, is emptied twice a day, that is, at dinner-time (noon), and in the morning.

"I can wash as white as snow from 500 to 700 sheep a day.

"The sheep-supports, J, are a new invention, and sustain the weight of the sheep directly under the jets, preventing the great force of the jets driving the sheep too far under the surface of the water, and thus lessening the action of the jet upon the fleece. They are formed of small rollers or cylinders, W, which turn with the sheep placed between them, and can be set higher or lower at pleasure by means of a sliding bar and key, X."

Further, in an admirably practical lecture delivered by him, Mr. Cox observes:—

"Having touched upon the principles that should guide the sheep-breeder, I cannot conclude without a short statement with respect to the getting up of the article produced for the market. My experience goes to prove that, however carefully you may breed your sheep, and however superior the wool may be which they grow, your returns will be disappointing unless the greatest attention is bestowed upon the washing of your clip.

"Everyone who has judiciously expended money upon the necessary plant and appliances for spout-washing his wool will freely admit that the returns are one hundred-fold.

"Some three or four years ago our sheep-owners were anxious to obtain the opinion of English manufacturers as to the general getting-up of their wool and the sorting of their fleeces. We used to get periodically the brokers' stereotyped report that 'so many bales of wool were sold—that the attendance of buyers was limited or otherwise—that some bales were seedy and moity,

and others rather tender'—all of which we knew, and, knowing, could not remedy; but we could never learn what the manufacturer said about it; whether it contained too much or too little yolk; too dry from over-washing, or too heavy from under-washing; was the sorting satisfactory, &c., &c.

"Well, we engaged the services of a gentleman who went through the cloth manufacturing districts, and who supplied us with much valuable information, which we utilised, and which I shall now be happy to impart to others. Our directions were never to use water for the soak beyond 110° Fahrenheit; never to use alkalies—such as potash, soda, or hard soap; but that any quantity of soft soap might be used; in fact, using it to any extent was merely a matter of £ *s. d.*; but that all alkalies destroyed the fibre of the wool, making it harsh and dry, and what the manufacturers say, making it work unkindly. The great object to be obtained in washing wool is not only to make it white, but to make it bright. After leaving the spout, the fleece, when squeezed by the hand, should puff out again, not feeling sticky, and should glisten in the sun with a peculiar brilliancy; if too little yolk is left in the wool it will be wanting in softness; if too much, it will become sticky, and, after a time, turn yellow.* The number of days that should intervene between washing and shearing must depend partly upon the state of the weather as well as upon the condition of the sheep. Yolk will rise quicker in fat sheep than in poor ones, but from two to three clear days is generally sufficient. In sorting we skirt very heavily, taking about one-half from the fleece, and making it into what we call broken fleece, or pieces and locks. The remainder is sorted into combing and clothing sorts."

In regard to English practice, two most experienced agricultural colleagues, altogether representative men, have kindly written in reply to my queries. One says: "I have never heard the opinion of any wool-stapler as to the best mode of managing wool, either before or after shearing." The other, in reply to a query as to the lingering custom of selling wool in grease, says: "It is quite true a great portion of the wool grown in Devon, Somerset, and Cornwall is sold in the grease, not having been washed on the sheep's back; and there is a great difference of opinion amongst farmers about it. . . . . The buyers prefer it well washed, and it is more marketable: in consequence, washing is becoming more general." I may add that the United States Agricultural Reports testify strongly to the same effect, viz., that wool should not be clipped "in the grease," but well washed on the sheep's back.

Mr. F. Barroby,† of Dishforth, near Thirsk, has recently lectured on sheep with due regard to the most wool and mutton in the least time. The sheep of the district were originally the Teeswater, improved by Dishley rams. The flesh was improved, still the wool was hard and not uniform in staple, with a large propor-

* The desirableness of this brilliancy in the wool is that manufacturers of merinos, de laines, and other light fabrics, will give extreme prices for it, as this bright wool only will take delicate dyes. Frenchmen are the best customers for this kind of wool, and their absence from or presence at the sales makes a difference of at least 1s. per lb. in the price.

† See his note, p. 320.

tion of coarse "kempy" Breech wool. As wool became of more and more importance, careful selection of both sexes remedied defects, and we inherit the improved as distinguished from the pure-bred Leicester. Experience in these matters is costly, but it is the best guide. A great objection to half-bred flocks is the loss in the wool of the breeding ewes: he speaks of wool improved by climate and keep.

Compared with the Lincoln Leicester, the improved Leicester is a rapid feeder: wool now-a-days is of quite as much importance as mutton.

Mr. Barroby said: "I will give the prices my wool has made since 1863, and leave you to judge as to the merits of my sheep as wool producers; the average weight for the twelve years being 8½ lbs., and about 1½ hogg to a ewe on the average. In 1863 they were 1*s.* 11*d.*; in 1864, 2*s.* 3½*d.*; 1865, 2*s.* 3*d.*; 1866, 2*s.*; 1867, 1868, and 1869, 2*s.*; 1870, 1*s.* 11*d.*; 1871, 2*s.* 1½*d.*; 1872, 2*s.* 7*d.*; and 1873, 2*s.* 2*d.* I have not heard of any fanciers of the Lincoln cross being able to show any better return on their wool account, and I may add that during these twelve years my father first, and afterwards I myself, took many prizes for wool at both the Royal and the Yorkshire shows, having to compete with both the Lincoln and Leicester cross, and the pure (or as I term them "showyard") Leicester. The Lincoln cross requires both judgment, consideration, and caution. To sum up, I prefer the improved Leicester to all the other breeds, because you can get them off sooner, then fill their places up with sheep bought in, and so turn your capital." Mr. Barroby entered upon the feeding of sheep, so as to produce the most wool and mutton in the least time. He said: "About the last week in June in my district, the lambs should be weaned. My practice is to have winter-sown tares, on which I put the lambs: the lambs should be allowed about a quarter of a pound of corn and a quarter of a pound of mixed cotton and oil-cake per day at first, with hay or straw. After the tares, I put them on either clover or grass fog, and follow up with either rape or early soft turnips. About the second week in September, as soon as the lambs begin swedes, they should be cut for them. By gradually increasing the quantity of corn and cake to a half pound of each per day and plenty of cut turnips, you can send most of your hoggs to market, after clipping them, in April. About seventy or seventy-five per cent. should go then if the season has been favourable, and although the wool may not be quite so good in the lustre as that clipped about the third week in May, still the good keep makes fleeces heavy and better grown." *

* Mr. Barroby, a neighbour of mine, has kindly revised this note.

The English wool-trade in 1869 found it necessary to issue to wool-growers the following caution:—

"Wool is sometimes shorn in places containing chopped straw or chaff, when particles of the latter get mixed, and cannot afterwards be separated from the wool, to the great deterioration of its value; but the Council refer more particularly to cases of a more reprehensible character. Thus, loss arises from the sheep not being properly docked or clagged before clipping; from the dockings and cots being sometimes wound up in the fleeces; and from want of proper attention in cleaning the fleeces when clipping, so as to keep them free from tar, stones, sand, earth, clay, dung, straw, grass, or other substances.

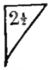
"This, which many years ago it was found necessary to guard against by special Acts of Parliament, frequently remains undiscovered for months, until the wool goes into consumption, and a notion has prevailed that by the repeal of these Acts of Parliament the buyer has been deprived of his legal remedy. The Bradford Chamber of Commerce have, however, in conjunction with the Worsted Committee of Yorkshire, Lancashire, and Cheshire, taken the opinion of an eminent Counsel on this matter, and they are assured *that the purchaser of such wool has a remedy at Common Law quite as effective as he formerly had by Statute.* Actions have been brought, and damages recovered, both in the Assize and County Courts.

"It is to be hoped that flock-masters will take due precautions against the recurrence of these acts of negligence on the part of their servants, which tend to destroy that confidence which should exist between the growers and consumers of wool."

By the favour of Mr. Tindall, I am enabled to give an exact account of the improved system of washing sheep, adopted by the late Mr. William Torr, at Aylesby Manor:—

"The tub used was made on the farm of the best 'red-wood deal,' 1½ inch thick.

"5 feet 2 inches long
"3 feet 1 inch wide
"2 feet 3 inches deep } within.

"Strapped up each corner 

, and capped at top, 7⅛ inches thick inside and out, 3 inches deep.

"The boiling copper holds 24 gallons of water.

"Soft-soap used, 1 lb. to every 20 sheep.

"Eight men are required: * four to stand at the washing-tub, one to catch and halter the sheep, one to stand at the head of the tub to keep the sheep's head above water; one to lead water into the *reserve* tub; one to boil soap, &c.

"About 30 sheep an hour, or 300 per day, can be washed, taking an average of hoggs and ewes.

"Fat hoggs, off turnip-land in the spring, we often wash twice, using half the quantity of soap the second time.

"We fill the washing-tub to about two-thirds full of ordinary pond-water; then fill the copper (24 gallons), into which we put 4 lbs. of soft-soap. When that has boiled well, put 6 buckets, or 18 gallons of this mixture, into the washing-tub to start with, then refill the copper, adding 1½ lb. more soap;

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* My friend and late colleague, Mr. Sanday (see p. 316), tells me he had a convenient wash-pit on the old plan; four men washed from 80 to 100 ewes, or 50 hoggets per hour.

then to every 10 sheep washed pour 2 buckets of the boiling soap and water into the washing-tub, refilling the copper, and adding each time half a pound of soap, and so on throughout.

"You want a *reserve* tub for a man to keep leading water into; and before each sheep leaves the washing-tub you pour over its back 2 buckets of water, and this, with what the sheep takes away in its wool, will keep your washing-tub at about the proper height." *

Mr. R. Taylor, Woolstapler, Bradford, tells Mr. Tindall: †—

"Wool is increased in value, by being well washed, 1*d.* per lb., and soft-soap adds lustre, and is very good for the sheep's skin. I recommend tub-washing with soft water."

Mr. Tindall further observes:—

"You get a great advantage over the ordinary dyke-washing in the driving. Often in May and June, when you take sheep to wash, the roads are one mass of dust (sheep make more dust than anything). Should there be any wind, and you drive the sheep 4 to 6 miles or more (as several farmers do in this neighbourhood), when you get home (the dust getting into the wet wool), your sheep are nearly as dirty as when you started them from home, whereas in tub-washing the sheep do not leave the farm, and get back to their pasture at once, mostly missing any driving on the highway-road."

For the following important communication, and for many other acts of kind and ready co-operation, I desire to express my most cordial acknowledgments:—

"Bradford Chamber of Commerce,
"Bradford, January 27th, 1875.

"My Lord,

"Your Lordship's communications to this Chamber have been submitted to the Wool Supply Committee.

"The getting-up of wool is a matter on which this Chamber has taken great interest, as will be seen from the reports and circulars forwarded to you. The Committee are of opinion that the best way of replying to the queries and remarks contained in your letters will be to state concisely their views in the following order:—

"1. That wool should not be washed or clipped before the first week in June, or later where the district is cold; the object being to have as much yolk as possible in the wool, so as to secure a good scour in the washing.

"2. The information and experience which the trade and the Committee have gathered during many years, leads them to say that washing in tubs under proper conditions is of great advantage to the wool, because (a) the yolk being a kind of natural soap, and found in greatest abundance at clip time, it follows (b) that, by washing in a stream or large pool of water, the valuable effects of this natural soap are, to a great extent, thrown away; and (c) in dyke and stream-washing the sheep have, in many cases, to be driven for miles along dusty roads; so that even where a thorough wash has been obtained at the dykes, its effects are partially neutralised on the return-

* Mr. Tindall tells me, that after sheep-washing the waste water is spread over a fold-yard, by which means any manurial matter the water may contain in solution is preserved.

† It is with great regret that I find space will not allow me to make a full note of a very practical communication I have received from Mr. Turner, Westgate Hill, Bradford; it came too late, but it strikes me as being very quaint and clever.

journey, and the wool is dusty and discoloured; tub-washing being conducted on the farm obviates this.

"3. The manner in which sheep may be most successfully and advantageously washed in this country is by having two tubs, each capable of containing, say, five sheep at a time. The first tub should be filled with soft water, and in this the sheep should be washed, care being taken not to change the water more than is absolutely necessary, only just as much fresh water being added as the sheep take out with them. The object of this is to get the water as yolky as possible. A second tub should be procured, which ought to be kept constantly full of clean water, so that, after leaving the first tub, the sheep could be plunged into it. The use of the second tub would, of course, be superseded in the vicinity of a stream, into which the sheep could be plunged on leaving the first; or, in fact, by any rinsing process equivalent to the Australian spout.

"4. The sheep should be properly docked previous to washing; thus preventing the dung and lumps of soil which adhere to the ends of the staples from discolouring the wool.

"5. Much of the advantage of good washing is frequently thrown away by carelessness in allowing the sheep to run, after washing, upon seeds or ploughed land, and also by allowing too long a time to elapse between washing and clipping.

"Taking into account that, as compared with Australia, English clips are not generally large, and also that the present operation is not really a costly one, the Committee are of opinion that the Australian system could not be economically introduced in this country, especially as tub-washing as herein described is in principle the same thing.

"What is wanted is more care and attention to this part of his business on the part of the British agriculturist; and as you remark that the outspoken opinion of this Chamber may be of service, the Committee venture to say that in this matter an amount of culpable slovenliness prevails on the part of the farmer, the evil effects of which are principally felt by those who deal with the wool in its succeeding stages, and which in any other branch of our national industry would not be tolerated.

"I am, my Lord, your obedient servant,

"JOHN DARLINGTON, Secretary.

"*To the Right Hon. the Earl Cathcart.*"

I have thus endeavoured to compress into a paper valuable matter that might well have filled a volume: conscious of shortcomings and imperfections, I hope that, in consideration of my excellent intentions, they may be readily pardoned. The enterprising gentlemen of Bradford, notwithstanding local drawbacks, have created for themselves and for their town a reputation which is world-wide, and that with a rapidity quite unparalleled in industrial history:* they at least, I am sure, need make no apology for being admirably outspoken; for indeed I am mistaken in his character if the educated English farmer cannot see and understand, as readily as any man, the wholesome truth hidden away in the old phrase—where or whence derived I cannot now remember—"The way to kill John Bull is to throw dust in his eyes!"

* London International Exhibition, 1871. Official Report, Part VII. p. 83.

X.—*Annual Report of the Consulting Chemist for* 1874.

It will, no doubt, be gratifying to the Chemical Committee to learn, as the result of my experience in the examination of various kinds of feeding-stuffs and fertilising-matters, during the last twelve months that fewer instances of fraudulently compounded oilcakes and of grossly adulterated artificial manures have been brought under my notice by members of the Royal Agricultural Society than in any preceding year.

Ever since the Council decided to give immediate publicity to the Quarterly Reports of the Chemical Committee, the analytical work for individual members has largely increased; and although not quite so many samples of artificial manures were sent to the Laboratory between December 1873 and December 1874, as in the preceding twelve months, the number of analyses for *bonâ fide* members of the Society still remains nearly double of what it was before the publication of the Quarterly Reports of cases of dealings in inferior or adulterated manures, cakes, &c.

The decided diminution in the number of cases of inferior or adulterated cakes and artificial manures, which has been specially marked during the last twelve months, is not due, as might be supposed, to a greatly diminished number of samples having been sent to me during that period, but is no doubt the natural result of the endeavours of the Council to check transactions in such articles.

There is no longer any difficulty in obtaining pure linseed-cake, or genuine Peruvian guano, or nitrate of soda unmixed with common salt; and farmers are learning more and more this important lesson:—to insist upon being furnished by the dealers with guaranteed analyses when they buy artificial manures and feeding-stuffs which may be prepared of various degrees of concentration, and the true money value of which cannot be ascertained without submitting them to analysis.

In several parts of England it has become a common practice of farmers to buy mineral superphosphate simply as a source of soluble phosphate of lime, and to pay a fixed price for each per cent. of soluble phosphate which the bulk is found to contain on delivery. This excellent plan of buying mineral superphosphate is rapidly extending over the country. It is not always possible nor convenient for a manufacturer to make from day to day mineral superphosphate of the exact strength which he desires to produce. It thus happens that the superphosphate which is sent out from time to time from the works varies to some extent in strength; and as the commercial value of this manure depends entirely upon the amount of soluble phosphate it contains, it is but fair that the buyer should pay for any extra quantity of soluble phosphate which the bulk may contain, on

delivery, over and above the guaranteed percentage; and, on the other hand, that he should be allowed to make a deduction in the price of the manure corresponding to the deficiency in the percentage of soluble phosphate which may be found in the bulk on delivery. I refer specially to this matter, because several cases have been brought under my notice during the last twelve months in which buyers of mineral superphosphate, adopting the plan of paying a certain price, say 3*s.* 6*d.* per unit per cent. for soluble phosphate, were allowed to make considerable deductions from the purchase price for deficiency in the guaranteed percentage of soluble phosphate. Supposing the superphosphate to cost 4*l.* 4*s.*, and to be guaranteed to contain 24 per cent. of soluble phosphate, the price for each unit per cent. of soluble phosphate will be 3*s.* 6*d.* If the manure, on delivery, should be found to test only 20 instead of 24 per cent., the buyer would be entitled to a deduction of 4 × 3*s.* 6*d.* = 14*s.* for every ton of superphosphate, and thus would have to pay 3*l.* 10*s.* instead of 4*l.* 4*s.* per ton. Differences of from 3 to 5 per cent. between the actual and the guaranteed percentage of soluble phosphate in mineral superphosphate I find occur much more frequently than might be supposed, and for this reason I would advise the members to make it a regular rule to draw a fair sample from a number of bags, thoroughly to mix them together, and to forward me a portion of the mixed sample for the determination of the percentage of soluble phosphate.

In consequence of the exceptionally low price of nitrate of soda, this salt has been used in the past season much more freely than in former years as a top-dressing for cereals and for grassland, either by itself or in conjunction with phosphatic manures. As many as forty-two samples, or more than twice as many samples as in former years, were sent for analysis in the past season, and all were found genuine and of good quality.

Potash-salts, on the other hand, as a rule, do not appear to find much favour in England, and not a single sample was sent for examination during the last twelve months.

Whilst the number of samples of nitrate of soda sent for analysis largely increased, fewer samples of Peruvian guano were received than in previous years. All the guanos were found genuine, and, with few exceptions, they yielded fully 12 per cent. of ammonia.

Although the percentage of ammonia in Peruvian guano has not declined, but somewhat increased, the condition of the present importations from the Guanape and Macabi Islands, as a rule, is anything but good. It is not unusual to find as much as 24 to 26 per cent. of moisture in Peruvian guano from the Guanape and Macabi Islands, and guano containing so large a percentage

of moisture is always more or less lumpy, and becomes pasty when the attempt is made to reduce it to powder. The difficulty of reducing such guano into a fine and powdery state, in which it can be readily and uniformly distributed upon the land, is much enhanced by the circumstance that some of the lumps, not dissimilar in appearance to dark-coloured wet clay, are as damp and unctuous as newly made Cheshire cheese; and others, which may be readily mistaken for stones, are so hard that they can only be broken and reduced to powder by means which are not at the command of the farmer. It may at first sight appear a simple matter to reduce to powder a material such as damp and lumpy Guanape guano; but it is a far more difficult task than it may appear to persons who have not made the attempt. In fact, the farmer cannot do this properly himself, and I have therefore advocated for years past the propriety of treating wet Peruvian guano with sulphuric acid, and preparing the sulphated guano into a dry powder.

In consideration of the difficulties which at present exist in the way of supplying Peruvian guano of a uniform composition and in a dry and fine condition, the Peruvian Government have recently consented that the present contractors for the sale of Peruvian guano in Europe might treat guano with sulphuric acid. Dissolved Peruvian guano is now prepared under the control of the Peruvian Government agents, and sold by them in a dry and finely powdered condition, with a uniform composition guaranteed by analysis.

All the samples of dissolved Peruvian guano which were sent for analysis by members of the Royal Agricultural Society in the course of last season were found fully up to the mark, and in an excellent mechanical condition.

It has been alleged that the phosphates in Peruvian guano exist in it in a sufficiently available condition to meet the requirements of the farmer, and that for this reason the manufacture of dissolved guano is a great mistake; and undoubtedly if Peruvian guano at present were as dry and easily reduced to powder as the former and now exhausted supplies from the Chincha Islands, there would be no necessity of treating guano with sulphuric acid.

The object of the manufacture of dissolved guano is not merely to render the ordinary insoluble guano-phosphates soluble, but to prepare the manure in a dry and powdery condition and of a uniform composition. This object is best accomplished by treating raw guano with about 20 per cent. of oil of vitriol; for in rendering the insoluble phosphate of lime in guano soluble, a certain amount of sulphate of lime is produced, which, combining chemically with a fixed quantity of water, acts as an efficient drying material; whilst at the same time the acid neutralises the

volatile and pungent smelling carbonate of ammonia which exists in damp Guanape and Macabi guano in considerable quantities, and thereby prevents loss in the most valuable constituents of Peruvian guano on keeping.

The sale of dissolved guano in Germany is greater than that of raw guano; and there cannot be much doubt that it will also be preferred to the latter by the British agriculturist when its superior fertilising qualities and real merits shall have been fully recognised by actual experience in the field, provided it can be sold at a fair price in comparison with other artificial manures.

The Peruvian Government made a great mistake in raising the price of guano at a time when the altered character of the present supplies, in comparison with the old Chincha Island guano, rather pointed to a reduction in the price; and it is to be hoped the Peruvian Government will recognise the propriety of offering to the public both raw and dissolved guano at such a price that, notwithstanding the increasing consumption of nitrate of soda for agricultural purposes, and the competition with compound artificial manures, they would be sure to hold their ground and give satisfaction to the buyer.

The Council of the Royal Agricultural Society has repeatedly urged upon the Peruvian Government the advisability of fixing the price of guano on the basis of a standard analysis, and there appears at length a reasonable prospect of effect being given to this recommendation.

With regard to feeding-stuffs, I have to report that the improvement in the quality of linseed-cakes continues to extend, and that the endeavours of the Council to suppress, if possible, the manufacture and sale of inferior and adulterated cakes have borne good fruits in the past year. Of the 210 samples of oilcakes and feeding-meals received during the last twelve months, the majority were found to be really good and pure linseed-cakes, and comparatively few were cakes of an inferior character.

However, the reprehensible practice of selling linseed-cakes made from dirty or badly-screened linseed as genuine linseed-cakes, although much diminished, has not been entirely given up in certain well-known quarters.

The inquiries respecting the management of particular soils as regards their suitability for certain crops, the selection of the proper manures, the improvement of grass-land, &c., have been more numerous than in former years; and as many as 41 soils, the largest number ever submitted to me in a single year, were sent for analysis and report. This shows an increasing desire on the part of agriculturists to derive benefit from the suggestions and advice which the Agricultural Chemist may be able to give to the occupier of land.

I have further to report, that in no year have I received so many samples of water for examination. As many as 61 samples of drinking-water were submitted to me for analysis in 1874, a good many of which I found largely contaminated with sewage, yard-drainage, and similar obnoxious liquids. The results of the analyses of these waters fully confirm the opinion which I expressed in a former Report, that the water with which country houses and villages are supplied is frequently largely impregnated with animal-refuse products, and is decidedly injurious to the health of those who drink it.

In view of the importance of this subject, I am preparing for the spring number of the 'Journal' a paper on the composition and qualities of drinking-waters, and on waters for the supply of steam-boilers and general domestic purposes.

The following are the papers contributed by me to the pages of the February and August numbers of the 'Journal' for 1874:—

1. On the Composition of Waters of Land-drainage.
2. Field-experiments on Permanent Pasture.
3. Report on the Composition of Thirteen Samples of Peruvian Guano. sent by the Secretary of the Admiralty to the Royal Agricultural Society.
4. Annual Report for 1873.

Analyses made for Members of the Royal Agricultural Society, December 1873, *to December* 1874.

Guano	33
Superphosphates, dissolved bones, and similar artificial manures	158
Bone-dust	20
Nitrate of soda	42
Sulphate of ammonia	6
Refuse manure	21
Limestones, marls, ironstones, and other minerals	34
Soils	41
Waters	61
Sewage	5
Milk	5
Oilcakes	178
Feeding-meals	22
Vegetable productions	12
Examinations for poison	7
	645

(Signed) AUGUSTUS VOELCKER, F.R.S.

Laboratory, 11, *Salisbury Square, Fleet Street, E.C., December* 1874.

XI.—*Report on the Health of Animals of the Farm.* By Professor J. B. Simonds, Principal of the Royal Veterinary College, and Consulting Veterinary Surgeon to the Society.

It might have been supposed that the health of the animals of the farm would have been greatly impaired, and that many cases of disease would consequently have resulted from the remarkable state of weather which prevailed during the past year. The drought of the early spring, which was continued throughout the summer, produced serious ill effects on vegetation, leading necessarily to a diminished crop of hay and roots; and thus, later on in the year, the greatest difficulty was experienced in almost every part of the country in finding sufficient water-supply and pasturage for cattle. These causes were, however, unattended with any marked ill consequences to the animals of the farm, except a serious fall in condition; and even when in the autumn the drought was followed by a copious rainfall, and consequently a rapid growth of grass and herbage, their health remained unimpaired, although very opposite causes were now in full operation. To this circumstance is to be attributed the fact that fewer communications relative to disease and fewer morbid specimens were forwarded to the College than usual. Indeed, I can scarcely call to mind a time when so small a number came to hand as during the last six months of the year.

Blood-poisoning.

It was not until the month of November that any case of importance had to be investigated. In this month my attention was called to the circumstance that several animals had died after a few hours' illness on a farm in Cambridgeshire. Assistant-Professor Axe was at once requested to visit the place, and investigate the nature and cause of the disease. He reported that the herd, which was the property of Mr. John Whittam, March, Cambridgeshire, originally consisted of sixty-five animals, namely, fourteen milch-cows, forty-three heifers and steers, and eight calves. They were divided into six lots, and placed in open yards, some of which were only separated the one from the other by ordinary posts and rails.

The disease first appeared on November 17th in a heifer, which had been brought from an adjacent homestead to the premises four days previously. This animal died after a few days' illness. On the 23rd, a steer in one of the open yards was attacked, and died in about three hours following. On the second day succeeding its death a third animal became affected,

and died in a similarly short period. The duration of the malady did not in any case extend over twelve hours, and the symptoms evinced during life were reported to have been as follows:—The first indication of disease which was observed was a sudden enlargement of the head and face, particularly about the lips—the under-part of the lower jaw, and around the throat. Tumefaction in these parts was soon followed by marked evidence of local irritation. The animal became restless, frequently shaking its head, and rubbing the swollen parts against any fixed object. The irritation gradually increased, and led to the greater portion of the hair being detached from the parts, and in some cases even to deep abrasions of the skin itself. A copious discharge of saliva from the mouth, and an occasional cough, were also present. The eyes were blood-shot and suffused with tears. The visible mucous membranes were congested; the pulse quick and weak; the respiration hurried, and the gait staggering; the animal soon afterwards suddenly falling and dying.

Mr. Axe made a *post-mortem* examination of the steer which died on the 25th of November, two days prior to his visit. The lesions observed were those of "*blood-poisoning*." The whole venous system was engorged with black blood, and many of the organs of the body exhibited either blood-extravasations or exudations of lymph. On inquiring into the general management of the herd, the following facts were elicited:—The young animals, among which the disease first appeared, and to which it was subsequently confined, were pastured during the summer-months on low-lying marsh-land. They were brought into the yards about the middle of October, at which time they were very low in condition. Three to four pounds of cake were now given to them daily, with a plentiful supply of oat and wheat-straw. Up to the 15th of November, the water-supply had been derived from an open dyke, but subsequently it was obtained from a stagnant pond immediately adjoining the yard.

From these facts Mr. Axe was of opinion that the disease owed its origin to the sudden change from scanty herbage to an abundant and highly-stimulating artificial diet; and that this cause of disease was probably added to by the water from the pond being charged with putrid animal and vegetable matter.

The measures adopted for arresting the spread of the malady had reference, first, *to the food*. The allowance of cake was ordered to be reduced to one-half, and the animals to be turned into a pasture for two or three hours in the day to seek a scanty supply of grass. Secondly, *to the water-supply*. The

use of water from the stagnant pond was forbidden, and as that from the dyke seemed to be fairly pure, instructions were given that it should be procured from that source. Thirdly, *to the sanitary condition of the premises.* All fodder, straw, and manure, which had been in contact with the sick or dead animals, or had otherwise become contaminated with their secretions, were ordered to be burnt. It was also suggested that lime-wash should be applied to the walls of the stables which had been occupied by the animals during their illness, and that the wood-work and fittings should be thoroughly washed with hot water and soap, and subsequently saturated with carbolic-acid solution, or a similar disinfectant. In addition to these measures, it was ordered that all the remaining animals should have a dose of aperient medicine administered to them without loss of time, and that this should be followed by the exhibition of antiseptic agents for several successive days. These preventive measures, I have been informed, had the effect of completely arresting the further spread of the malady.

Foot-and-Mouth Disease.

It was also during the month of November that the present serious outbreak of foot-and-mouth disease had its beginning. During August, September, and October scarcely a rumour reached me of the existence of the malady either in Great Britain or Ireland; and it was believed that, with the exception of some parts of Switzerland, the malady had no great prevalence in any part of Europe. Even in November little was heard of the disease until nearly the end of the month. The first intelligence came from Essex, and this was quickly followed by reports of its re-appearance in many parts of Sussex. The first cases in these counties were clearly traceable to diseased animals bought at Romford market, and at fairs held at Horsham and East Grinstead. Presently I had notice of the occurrence of cases in Oxfordshire, Yorkshire, and Lancashire, and diseased animals began to find their way to the Metropolitan Market from many other parts of the country.

The cattle exhibitions held at the close of the month and beginning of December contributed also to extend the area of the malady. One case occurred on the last day of the Show of the Smithfield Club, and although the animal was quickly removed and given in charge to the officer of the local authority, yet, as no restriction was placed on the movement of the others, it cannot be doubted that their dispersion throughout the country contributed to the spread of the disease. A similar occurrence was also reported from Leeds. Two animals were attacked in

the Show-yard and removed, and on the breaking up of the Show some of the other animals were sent to the exhibition at Newcastle, taking the disease with them.

At the date of this report, February 10th, the malady prevails to a very serious extent in the county of Norfolk, many thousands of cattle and sheep being affected. The virulence of the disease is shown by the circumstance that large numbers of sheep are attacked a *second time*, soon after their recovery from the first attack, and that vesicles are developed in the mouth as well as the feet of the animals, a symptom rarely observed in sheep.

Foot-and-mouth disease is also widely spread on the Continent, and during the past month of January upwards of 1600 diseased animals were landed at the various ports. The countries chiefly infected are Germany, Belgium, and France; cases also exist in the Netherlands. In France the sheep are suffering as well as the cattle, and apparently as severely as in the county of Norfolk. Imported cattle from France are found to be chiefly affected in their feet; but it is remarkable that many which come from Germany are so severely affected in the mouth as to present *local symptoms not very dissimilar to those of the cattle-plague.*

With reference to foreign importations, it may also be observed that during last year a greater number of cattle arrived from Schleswig-Holstein than for some time past, and not one case of foot-and-mouth disease was detected among them, although other parts of the German Empire are known to have been not entirely free from the malady.

It is likewise a singular fact that no case of foot-and-mouth disease has been detected among the cattle landed from Ireland, which have to a certain extent been inspected during the last six months at the several ports at which they arrive.

Typhoid Fever in Pigs.

In connexion with the outbreak of foot-and-mouth disease, and its rapid spread in its epizootic form, one other contagious malady requires to be noticed in this report, namely, *typhoid fever in pigs.* This affection likewise manifested itself at the latter part of November. My first information of its existence came from Somersetshire, and within a few days of this, the carcass of a pig was forwarded from Leicestershire, which, on examination, showed that the animal had been the subject of typhoid fever. Since then numerous cases of the disease have occurred in the first-named county; but up to the present time I have not heard of the spread of the malady elsewhere.

Typhoid fever ranks among the most contagious and fatal

diseases affecting the pig, and the history of the malady in this country, as also on the Continent, distinctly shows that at times it assumes an epizootic character. This was especially the case in 1865, when the especial attention of the Society was called to the subject by Dr. W. Budd, of Clifton, and myself. Dr. Budd read at that time a valuable paper on the disease at one of the Society's meetings, which was followed by an important and instructive discussion. This paper, with illustrations of the lesions produced by the malady, especially in the intestinal canal, will be found in Vol. I., 2nd Series, of the Society's 'Journal,' to which I would direct the attention of the members of the Society.

The spread of the disease in Somersetshire has been clearly traced in several instances to the sale of infected pigs in the markets of the county; and in one case, the last which has been reported to me, the malady was carried to a herd of healthy pigs by a butcher's man who had been called to a diseased animal for the purpose of slaughtering and dressing it for sale. It would appear that already in the neighbourhood of Bath something like two hundred pigs have fallen a sacrifice to typhoid fever. Preventive measures, and essentially isolation and disinfection, will alone avail to keep this fatal disease in check.

(Signed) J. B. Simonds.

XII.—*Annual Report of the Consulting Botanist for* 1874.

The investigations instituted into the nature of ergot, its occurrence in pastures, and the injuries produced by it to brood-animals have been completed during the past year, and the results published in the last number of the Journal of the Society.

The experiments on the cultivation of the potato, and the incidence of the potato-disease, have also occupied my time and attention. At the request of the Special Committee appointed in connexion with this subject, I visited all the experimental crops during the months of July and August, besides acting as judge in the districts of the south of England. The observations made during this inspection, together with the books of the growers and the reports of the judges, which have been placed in my hands, are being employed in the preparation of a report embodying the information as to the growth of the same varieties of potato under different treatment, and in different soils and localities, and the times and conditions under which the disease appeared. This report will appear in the autumn number of the 'Journal,' its preparation having involved so much calculation, and other time-consuming work, that I have been unable to complete it in time for publication in the spring number.

I have also advised members of the Society as to parasitic and root-diseases attacking cultivated plants, the weeds and foreign plants occurring in pastures, and other subjects submitted to me. But nothing of sufficient novelty or interest has in this way been brought before me during the past year deserving of special notice.

I have had submitted to me samples of grass and other seeds to examine for their freedom from weeds, and to test as to their germinating power. In several cases I have prevented members of the Society from making more or less worthless purchases, and my report as to dead clover-seed in samples offered by a firm of seed-merchants has had a very satisfactory effect on the dealer.

(Signed) W. Carruthers, F.R.S.

ADDITIONS TO THE LIBRARY IN 1874.

I.—PERIODICALS PRESENTED TO THE SOCIETY'S LIBRARY.

Presented by the respective Societies and Editors.

A.—English, American, and Colonial Periodicals.

Agricultural Economist. Vol. V. 1874.
———— Gazette. Nos. 1–52. 1874.
American Agriculturist. Vol. XXXIII. 1874.
———— Institute, Transactions of the. 1870–2.
Athenæum (Journal). Nos. 2410–2461. 1874.

Bath and West of England Society, Journal of the. Vol. VI. 1874.
Barbadoes, Report upon the Rainfall of. 1874.
Bell's Weekly Messenger. Nos. 4021–4072. 1874.
Bristol Mercury. Vol. LXXXV. 1874.
Bussey Institution, Bulletin of the. Parts I. and II. 1872.

Chamber of Agriculture Journal. Vol. X. 1874.
Connecticut Board of Agriculture, Fifth and Sixth Annual Reports of the Secretary of. 1871–3.
Country Gentleman's Magazine. Vol. XI. 1874.

Economist. Vol. XXXII. 1874.
Essex Standard. Vol. XLIV. 1874.
Farmer. Vols. XXII. and XXIII. 1874.
Farmer's Herald. Vol. XXI. 1874.
Field. Vols. XLIII. and XLIV. 1874.

Geological Society, Journal of the. Vol. XXX. Nos. 117–120. 1874.
Highland and Agricultural Society of Scotland, Transactions of the. Vol. VI. 1874.

Institution of Civil Engineers, Proceedings of the. Vols. XXXVII. and XXXVIII. Parts I. and II. 1873–4.
Institution of Mechanical Engineers, Proceedings of the. 1874.
——— of Surveyors, Transactions of the. Vol. VI. 1874.
Investor's Monthly Manual. Vol. IV. 1874.
Irish Farmer's Gazette. Vol. XXXIII. 1874.

Mark Lane Express and Agricultural Journal. Vol. XLIII. 1874.
Midland Counties Herald. Vol. XXXVIII. 1874.

Nature. Vols. IX. and X. 1874.
New Haven. American Journal of Science and Arts. Vols. VII. and VIII. 1874.
New South Wales, Journal of the Agricultural Society of. Nos. 1–3. 1874.
New York State Agricultural Society, Transactions of the. 1871.
North British Agriculturist. Vol. XXVI. 1874.
North of England Farmer. Vols. VIII. and IX. 1874.

Ohio. Geological Survey of, Report of Progress in. 1870.
——. Twenty-seventh Annual Report of the State Board of Agriculture for the year 1872.
Ontario. Annual Reports of the Commissioner of Agriculture and Public Works for 1872–3.

Royal Geographical Society, Journal of the. Vol. XLIII. 1873.
———, Proceedings of the. Vol. XVIII. 1874.
Royal Horticultural Society, Journal of the. Vol. IV. Parts XIII. and XIV.
Royal Institution of Great Britain, Proceedings of the. Vol. VII. Parts I.–IV. 1874.
Royal United Service Institution, Journal of the. Vol. XVIII. Nos. 76–78. 1874.

Society of Arts, Journal of the. Vol. XXII. 1874.
Statistical Society, Journal of the. Vol. XXXVII. Parts I.–IV. 1874.
Tasmania. Statistics of the Colony for the year 1873.
United States. Report of the Commissioner of Agriculture on the Diseases of Cattle in the. 1871.
Veterinarian, The. Vol. XLVII. 1874.
Victoria. Report of the Secretary for Agriculture. 1874.
Vienna Universal Exhibition, Reports on the (with Maps and Plans). 1874.
Washington, U.S. Smithsonian Miscellaneous Collection. 1873.
———. Synopsis of the Flora of Colorado.
Wisconsin State Agricultural Society, Transactions of the. Vols. X. and XI. 1871–3.

B.—Foreign Periodicals.

Brussels. Société Centrale d'Agriculture de Belgique. Journal. 21me Année, Jan.–Sept. 1874.
Buenos Aires. Añales de la Sociedad rural Argentina. Vol. VII. 1873.
Göttingen. Journal für Landwirthschaft. 21ter Jahrgang. Hefte 1–4. 1873.
Lisboa. Revista Agricola. Jornal da Real Associação Central da Agricultura Portugueza. 8° anno. 1874.
Munich. Landwirthschaftliche Verein in Bayern. Zeitschrift. 63ter Jahrgang. 1873.
———. Haus- und Landwirthschafts-Kalender des Landwirthschaftlichen Vereins in Bayern. 1874.
Paris. Société des Agriculteurs de France. Bulletin Mensuel. 6me Année. Vol. VI. 1874.
——. Journal d'Agriculture pratique. Vols. I. and II. 1874.

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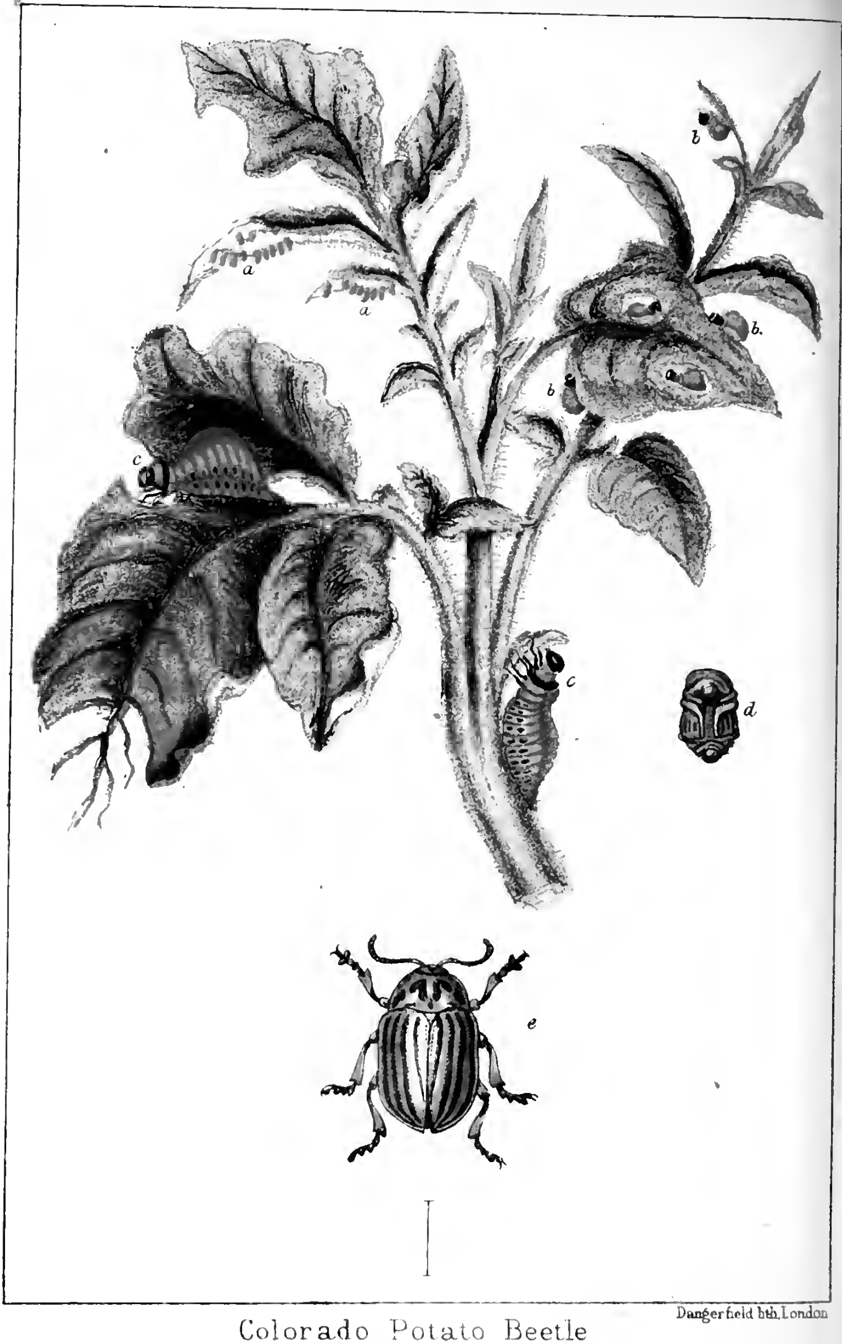

Dangerfield lith. London

Colorado Potato Beetle

a. eggs
b young larvæ
c full grown larvæ
d pupa
e perfect insect (the line beneath shews the natural size.)

JOURNAL

OF THE

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

XIII.—*The Colorado Potato-Beetle.* By Henry Walter Bates, F.L.S.

[With a Plate.]

During the past two years the agricultural world, and, to some extent, the general public in most countries of Western Europe, have been much excited by the reports of a new danger threatening the potato crop, in the shape, this time, of a beetle from America, which has spread with amazing rapidity from the Rocky Mountains eastward over the Northern States, attacking the potato fields in countless myriads, and destroying the tubers by stripping the plants of their leaves. The alarm was first started in the Far West, in Nebraska, in 1859; since then the plague has spread eastward, at the rate of about seventy miles per annum, until in the last and present years some of the States bordering the Atlantic, including Pennsylvania and New York, have seen their fields invaded by the devouring hosts. The excitement consequent on the phenomenon has been propagated chiefly by highly coloured accounts published in American newspapers; and to such effect that several Continental Governments—Germany, Belgium, France, Russia, Holland, and Spain—have passed laws to prohibit or place under strict regulations the importation of potatoes from the United States. The subject, as we all know, has led to some Government inquiry in our own country, with the result so far that the opinion of the Board of Trade has been acted upon, and our import trade not interfered with, except that the custom-house officers have been instructed to see that haulm and loose soil brought with potatoes from America, either as ships' stores or for importation, are burnt and not allowed to be carried inland. The question has been much more discussed on the

Continent than in England, especially with reference to the probability, judging from analogous cases of migration of insect pests, and the habits of the potato-beetle, of its introduction into Europe; and the result has been, up to the present moment, to leave the matter in considerable doubt. One cannot read, for instance, the discussions, repeatedly adjourned, of the Entomological Society of Belgium last spring, in which some of the ablest professors of the science in Europe took part, without perceiving that no conclusion has been arrived at calculated to set at rest the public mind with regard to it. In the review of the subject which here follows, I think it will be made clear that we have no valid grounds for fearing that the pest—should stray specimens accidentally arrive—will ever make good its footing in the British Islands. The history of the beetle is, however, well worth relating to English agriculturists; and an account of the means, more or less successful, by which the danger has been combated in America will be useful, should the creature, in spite of all reasons to the contrary, pay us a visit.

The Colorado Potato-beetle, or "bug" (as it is misleadingly termed in America), unlike most insect pests, is not liable to be overlooked by reason of the smallness of its size and the hidden nature of its habits. It is a conspicuously coloured beetle, rather more than the third of an inch in length; of plump, oval form, and of a creamy-yellow colour, with ten black stripes along its back, or rather its wing-cases, which, when closed, as they are in repose, cover the greater part of its upper surface. The stout legs, with their broadish feet, beautifully adapted for clinging to the surface and edges of leaves, are almost wholly of a reddish colour, and the fore-part of the body is yellow, with black markings. It has a pair of well-developed membranous wings, folded under the closed wing-cases, which it uses only in the warm days of summer, and, as it appears, only when requiring to migrate from one field or district to another. But it flies slowly and heavily, the rosy colour of its wings contrasted with the gaily-striped wing-cases rendering it in its flight a very conspicuous object. We have no native beetle or other insect in the least resembling it; and it would probably attract the attention of anyone as something strange and foreign should stray specimens be seen in our fields, or, what is more likely, at any of our sea-ports. Its scientific name is *Doryphora decemlineata*, and it belongs to the family *Chrysomelidæ*, of the great tribe *Phytophaga*, or plant-eaters, of the order *Coleoptera*. Many species of the same family are well known to the curious as inhabiting Britain, some of them as large and conspicuous as the dreaded *Doryphora;* but they are differently coloured, and have not yet rendered themselves obnoxious by transferring their

tastes from the wild plants on which they naturally feed to cultivated products.

The habits of the *Chrysomelidæ*, at least in the active period of their lives, are exposed to the light of day, and easily observed. The Colorado potato-beetle forms no exception to the rule, and this has rendered comparatively easy the application of remedies to its devastations. Like all other insects of the order to which it belongs, it undergoes transformations in its growth from the egg to the adult or beetle-state; emerging from the egg as a grub or "larva," having six horny legs attached to the anterior part of the body, and a very convex and corpulent abdomen; passing into the "pupa" or dormant state after about seventeen days of larval life; and escaping from the ruptured skin of the pupa as a beetle at the end of ten days more. But the parent beetles, eggs, and larvæ, are all confined to the leaves of the plant, the beetles and larvæ feeding in broad daylight on the green leaves only, and completing their transformations during the summer months. The pairing of the male and female beetles, and the deposition of eggs, also take place on the leaves. The only hidden features in the economy of the creature are those attending the transformation of the pupa, and the hybernation of the last brood of beetles at the end of summer. With regard to the former the process is as follows:—The larva, when fully grown, and after several successive changes of skin, enters the earth to change into the pupa state, forming a rounded cavity or chamber in the soil, the grains of which become somewhat compacted, so as to form a sort of fragile earthen cocoon. It remains in this stage, as already observed, only about ten days, emerging from the ground at the end of that brief time as a perfect beetle, ready to commence a new generation. The hybernation of the beetles also takes place under ground. This is a point in the life-history of the insect of great importance in view of the chances of its importation into Europe, and, fortunately, the testimony of American observers leaves us in no doubt as to the principal facts. Towards the end of the summer the last generation of the insect has been completed; there remain no eggs or larvæ on the plants, and the perfect beetles which survive do not pair (or, at least, lay no more eggs), but burrow their way beneath the soil, and there remain quiescent until the spring of the following year. The period when this takes place is before the chief crop of potatoes is taken out of the ground, namely, in the month of October. This is in the State of Missouri, in a latitude and climate corresponding nearly to the extreme South of Europe. The beetles in hybernating do not descend generally more than 18 or 20 inches below the surface of the soil, nor do they form a chamber of compacted earth, which

would give them protection should they be dug out accidentally and transported in that state. We have full assurance also that they do not enter the dried haulm of the potato; but it is not quite so sure that they might not seek the protection of masses of withered and curled-up leaves, inasmuch as Mr. C. V. Riley, State Entomologist for Missouri, to whom the world is indebted for almost all the authentic information we possess regarding the beetle's habits, has found them concealed in winter under various substances lying on the surface of the ground. The general habit, however, appears undoubtedly to be to hybernate at considerable depths in the loose soil of the potato-fields which the insects had infested in the previous summer.

The potato-beetle is thus seen to be no insidious enemy, like the majority of insect plagues, but it meets the agriculturist in open fair fight. It was originally stated, however, by Dr. Shimer, of Illinois, that it hybernated in the pupa as well as the beetle state. This has lately been repeated by Continental writers on the subject; but Mr. Riley, in his latest Reports to the State Board of Agriculture for Missouri, positively assures us it is not the fact. Even if it were, it would not be of much practical importance, inasmuch as the pupa and its slight earthen cocoon, which, if extracted from the ground, would be of about the size of a sparrow's egg, are of so fragile a texture that they could not possibly survive transport mixed with heavy loose substances.

Such is the Colorado potato-beetle, and such are the main features of its life-history which chiefly concern the European agriculturist and the general public. I will now proceed to give a summary of its career in America, derived from the most trustworthy authorities. The origin, character, and progress of its depredations present points of unusual interest, which concern students of Natural History as a science, quite as much as the potato-grower.

American Naturalists agree in the conclusion that the potato-beetle is not originally a native of the country east of the Rocky Mountains, where it has of late become so notorious for its ravages. Statements to the contrary were founded on the mistake of confounding the species with an allied one, the "Bogus Potato-beetle" (*Doryphora juncta*), a native of the Middle States, which feeds only on a wild *Solanum*. The true potato-beetle was discovered in the region since known as the Territory of Colorado (lat. 38° to 40°), in 1824, by the entomologist, Thomas Say, who accompanied the Government Expedition of that year under Major Long; and was found by him feeding on a wild species of *Solanum* (*S. rostratum*) peculiar to the Rocky Mountains. On that and on an allied species, *S. cornutum*, it is still

met with in the same region. Here for years after its discovery it lived, as before, a harmless life, like the rest of its congeners, and was by no means a common insect. According to Mr. Benjamin Walsh, State Entomologist for Illinois, it was only when the cultivation of the potato reached the base of the Rocky Mountains, with the advance of colonisation westward, that the creature displayed a taste for the introduced plant, so nearly allied to the economically worthless one which constituted its native food. It was first noticed in potato-fields in 1859, about 100 miles west of Omaha, in Nebraska, and was at that time spreading rapidly eastward. In 1861 it invaded Iowa, the next State on the east, and in 1864 and 1865 it crossed the Mississippi into Illinois. The sudden appearance of a new foe to the popular esculent, and the destruction it caused to a crop of such great domestic and commercial value, filled the Western farmers with dismay, and the local newspapers teemed with accounts of the havoc it was causing. In the warm weather, towards the end of spring, the beetles and their voracious larvæ swarmed over the fields, and in a few hours denuded the growing plants of their tender leaves; effectually arresting the growth of the tubers. Their work completed in one district, the beetles took to the wing and migrated to others. Barns, houses, sitting-rooms, and bedchambers were invaded by the encroaching pests. In 1866 they overran the Southern parts of Wisconsin; in 1867 they passed into Indiana (east of Illinois), and spread over its borders into Ohio; in 1870 they crossed the broad St. Clair River and entered Canada. By 1873 the onward-spreading pest had reached Quebec, and, further south, had entered the States of Vermont, New York, New Jersey, Pennsylvania, and Maryland. The prophecy of the Illinois entomologist, Walsh, recorded in the autumn of 1865, to the effect that the insect would eventually reach the Atlantic, has been verified sooner than he expected.

In this sketch of its progress it is not to be understood that, like a flight of locusts or a herd of buffalo, the hosts of the potato-beetle travel onwards, leaving free the districts behind them. It appears that American farmers in some States consoled themselves with the belief that it would be so; but, in fact, the pest establishes a permanent colony wherever it goes, only the surplus population of the prolific creature moving off to new fields; and notwithstanding the energy with which it has been combated it has in no place yet been entirely eradicated. It is reported to have been more numerous in Missouri in 1871 than in any previous year. Some of the details of its migrations given by Riley are calculated to impart a lively idea of the strength of the impulse which urges it forward, and the difficulties that

must attend all efforts to resist it. He reports that in 1871 the Detroit River, separating the State of Michigan from Canada, was literally swarming with the beetles, and that they were crossing Lake Erie on ships, chips of wood, staves, boards, or any other floating object which presented itself. "They soon infested all the islands to the west of the lake, and by June they were common around London (Canada), finally occupying the whole country between the St. Clair and Niagara rivers" (lat. 43° N., corresponding to the south of France). In the spring of 1871 the beetles swarmed in the streets of St. Louis, Missouri. They were said about the same time to have appeared in immense numbers on a potato patch belonging to Indians on the northern shore of Lake Superior (in lat. 48°, corresponding to the north of France), although no potatoes were cultivated within 150 miles of the place; thus making a leap which it was very difficult to account for. In the summer of 1873 the waters along the southern shore of Lake Erie, at the place where it is broadest, were again observed to be swarming with the living beetles, and at Painesville, in Ohio, clouds of them were seen flying westward, composed, according to a newspaper report, of tens of thousands of individuals. Their occurrence in abundance on the shores of lakes and on floating substances is, no doubt, to be accounted for by their having been precipitated into the water owing to the collapse of their powers whilst blindly attempting to fly across a broad expanse of water. I have often had occasion to notice a similar phenomenon on the borders of the riverine lakes of South America, where in the morning, after a squally night succeeding a sultry evening, continuous ridges, composed of half-drowned winged insects of all orders, and including even small birds, have been found cast up by the waves. Swarms of migrating "lady-bird" beetles are sometimes seen congregated on the southern and eastern coasts of England; and occasionally numbers of them have been found in a drowned state cast up on the beach, the result of their vain attempts to fly across the channel; but more frequently their instinct serves them better, and they try to go no further, for to this cause appear to be due the vast assemblages of these insects noticed in some seasons in our southern maritime districts.

Last summer the beetle reached the maritime districts of the middle Atlantic States. Accounts were published in England of its having devastated potato-fields in Pennsylvania in the month of August, and injured the growth of the tubers to that extent that it did not repay the trouble to take them out of the ground. In fields that were not attacked till September the plants above ground were quickly destroyed, but in such cases the tubers, having attained their growth before the leaves were

eaten, not much damage was done. During the present season the beetle has become much more general and abundant along the eastern seaboard, and I am informed by Mr. Riley (now on a visit to England) that it swarms at the present time (June) in the neighbourhood of New York.

From the foregoing summary it will be seen that in its dissemination eastward from its original home in Colorado, this extraordinary beetle has kept pretty closely to the same parallels of latitude as the region where it was first observed, that is, between 35° and 44°, with the exception of its isolated descent on the northern shores of Lake Superior in 48°. At the commencement of its progress, according to Mr. Walsh, it seemed to march through the Western States in many separate columns, but the southern columns lagged behind the northern, and we are told by Mr. Riley that it has not spread south of 37°. With regard to its northern limits, we are assured by Professor G. Lawson that it is quite unknown in Nova Scotia (lat. 44°–46°), where the summer climate is believed to be too cold and moist for the species.

The effect on the cultivation of the potato, and on the price of this indispensable article of food, in those States which have been subject to the ravages of the beetle, has been very serious; but the consequences have not been so disastrous as they would probably be in a country of less resources than the United States. Mr. Riley estimated the loss to cultivators occasioned by the pest in one year (1871) in Missouri to be nearly $500,000, although a great part of that State is situated to the south of the belt of country ravaged by the insect. The production in that year, as compared with 1870, had fallen off fully 20 per cent. in Missouri, 35 per cent. in Illinois, and 34 per cent. in Michigan. But a more vivid idea of the damage than can be conveyed by statistics is imparted by the general remarks contained in his Report for 1873. He says: "A great many persons in the States to the north of us must either have become discouraged, or have failed in the cultivation of potatoes, which have reached as high as two dollars a bushel, wholesale, in the St. Louis market. Indeed, the present scarcity and consequent high price of potatoes all over the country has very generally been attributed to the fact that the beetle discouraged so many from planting. There was a time, and that but a few years since, when the potato was one of the cheapest and surest products of the farm, and furnished not only the most wholesome and palatable article of human food, but entered largely into the feed of all kinds of stock. At the ordinary restaurant one could always depend on a good mealy potato, if nothing else invited to satisfy hunger. To-day the

rot, and more especially the Colorado potato-beetle, not to mention other enemies, have made it one of the most precarious of crops, as well as one of the most expensive to raise. It is no longer fed to stock; and many a family was this winter deprived of its use, as a luxury that could not be afforded. Under the attacks of its numerous enemies it has also degenerated; and instead of the delicious mealiness of former years it presents too often a soggy, watery, and unwholesome appearance at the table. This state of things may doubtless, in a great measure, be remedied by cultivating the newer and more vigorous seedlings, and by more care in mastering our coleopterous immigrant from Colorado."

Many remedies have been tried to check the ravages of the pest, including the mechanical process of sweeping the insects off the plants by various simple contrivances that were invented, which the slight hold the bulky insects had on the foliage rendered to some degree effectual. The different kinds of vermin poisons, such as powdered hellebore sprinkled on the leaves, carbolate of lime, slacked lime, bichromate of potash, and other drugs, found useful in most cases of insect depredations, were tried with very little effect, and cultivators appear at length to have settled down to the use of Paris or Scheele's green (arsenite of copper), the cost of applying which is about five dollars to the acre. To produce the fullest effect it appears necessary to use the best quality of the poison (that containing as much as fifty-nine per cent. of arsenious acid), and to mix it as a powder, one part of the "green" to twelve or fifteen parts of flour, ashes, plaster, or slacked lime (flour being the best, though the most expensive); the mixed powder is placed in a short cylindrical box with a perforated bottom, attached to a stick three or four feet long, and thus shaken over the plants in succession. Mixed in this way it kills the insects, but does not injure the leaves, although the fields treated with the poison have a disagreeable, besmeared appearance. If used pure and too abundantly the "green" will kill the plants as effectually as the beetles would, but applied judiciously we are assured it is efficient and harmless. The poison is allowed, however, to be a dangerous article to have lying about farm-houses, and the most scrupulous precautions are required to be taken. There is even danger of poisoning to the labourers who apply it, through the dust being absorbed by the skin, especially when perspiring, and on this account it is recommended to be applied only in the cool of the morning, at which time it has the further advantage of being more efficacious on account of the dew causing the dust to adhere better to the leaves. Farmers, however, are enjoined to keep a supply of the antidote at hand, in the shape of hydrated sesquioxide of iron, "a

few spoonfuls of which are to be taken in cases where symptoms of poisoning show themselves." It is to be hoped that English farmers may have no occasion for resorting to so desperate a remedy. Much discussion has taken place in America regarding the effect, on the soil and the tubers, of the inevitable washing in of quantities of the poison; some cultivators having asserted that peas planted in soil which had been mixed with the green had rotted immediately and failed to germinate, but Mr. Riley has proved by experiment that no harm is caused. He planted five rows of peas, using no green on the first, a little on the second, and increasing the amount on the others, so that on the fifth the peas had, in addition to that mixed with the soil, a covering of about one-eighth of an inch; the peas all grew and bloomed without noticeable difference, and were finally eaten with impunity by a cow. There seems to be no doubt, however, that wherever the beetles are not in excessive numbers, persevering hand-picking is sufficient to check their devastations. The best way to do this is to watch for their first appearance in spring and destroy them before they have time to pair and propagate their kind.

The experience of a few years in the Western States has shown that the natural enemies of the beetle—insectivorous birds, and parasitic or predacious insects—are capable by themselves of checking the increase of the pest, and the fullest details are given by Riley and others regarding the forms and habits of these allies of the cultivator, so that when seen they may be treated as friends. It is a curious fact that for the first year or two of the appearance of the potato-beetle in any district, these vermin-killers seem not to find out the palatableness of their new prey; but they gradually become accustomed to it, and afterwards increase in numbers in proportion to the increase of their victims. At first none of the domestic poultry, with the exception of ducks, would touch the insects, probably on account of the fluid exuded from the mouths of the beetles, which has a highly astringent taste, and an acrid property which causes a slight burning when it is applied to the skin. But afterwards fowls learned to feed upon them, and now when turned loose in the fields devour immense quantities. The rose-breasted grosbeak (*Guiraca Ludoviciana*) renders also great service by the number it destroys; formerly a scarce bird in the West, it has become common, at least in the State of Iowa, since the invasion of the *Doryphora*. But the most effective destroyers are members of the insect class, particularly a small parasitic fly (*Lydella Doryphoræ*), from the eggs of which, laid in clusters on the neck of the larva of the beetle, maggots are soon hatched, which penetrate the skin, and kill their prey by devouring the entrails. Six

species of "ladybirds" (*Coccinellæ*) also destroy vast numbers —the ladybird beetles themselves and their larvæ both eating the *Doryphora* grubs on the plants. Besides these, several predacious two-winged flies (*Asilus*), beetles (*Harpalus*, *Calosoma*, *Lebia*, *Brachinus*, &c.), wasps and true bugs (*Hemiptera*), have been found preying upon the beetles or their larvæ. To the combined effect of the increased number of these natural enemies and the use of the Paris green it is said the ravages of the potato-beetle in the States first affected have lately much diminished, and the pest no longer inspires the dread it did formerly.

The all-important question for the agricultural interest and the public of the British Islands is, What are the chances of the arrival and acclimatisation of this dangerous insect in this country? The neighbouring States of the Continent have taken alarm, and their Governments, after obtaining the advice of scientific bodies, have, as already stated, placed the importation of American potatoes under close restrictions or prohibited it altogether. But the persons best qualified to form an opinion, the skilled entomologists of those countries, are by no means unanimous in believing even in the possibility of its establishing itself in Western Europe. Strictly analogous cases of insect migration from which to judge are wanting. In the first place, no single instance is known of a native American beetle becoming acclimatized in Europe. We have a striking case of the establishment in Britain of a troublesome weed from North America, the canal plant (*Anacharis alsinastrum*), which in an incredibly short space of time propagated itself throughout the country in all places suited to its habits; but no similar invasion by an insect species can be cited. The nearest approach to such a case is that of the vine destroyer (*Phylloxera vastatrix*), which has caused such havoc in French vineyards, and which Mr. Riley has proved to be an American insect, introduced with American varieties of grape-vine into France. But it is objected that this insect (an almost microscopic creature allied to the plant-lice) is too different in organization and habits from the highly organized potato-beetle to be quoted as an example. The *Phylloxera* is a parasite, with all the tenacity of life and indestructibility of its class, and as such more liable than a freer type of insect, like the *Doryphora*, to be introduced anywhere with the plant to which it is inseparably attached. This insect is, however, the nearest analogous case we have to guide us. Reverse cases, that is, cases of the introduction and spread of European species in North America, many of them proving there destructive pests, are numerous enough. Thus the common English cabbage-butterfly (*Pieris rapæ*) introduced

into America at Quebec about the year 1856-7, probably, it is said, in the egg state on refuse cabbage-leaves, has increased and spread over all the Northern States; and from the habit possessed by its caterpillar of burying itself in the heart-leaves of the growing cabbage, and devouring them, has become a great nuisance. It is estimated to destroy annually around Quebec 240,000 dollars' worth of this vegetable. The wheat-midge or Hessian fly (*Cecidomyia destructor*), the codling-moth or apple-worm (*Carpocapsa pomonella*), the gooseberry sawfly, the bee-moth or wax-worm (*Galleria cereana*), besides many parasites of domestic animals, all well-known European insects, are so many other instances. But the case which more nearly concerns us is that of the Asparagus beetle (*Crioceris asparagi*), from the fact of its belonging to the same tribe as the Colorado potato-beetle, and having similar habits. This well-known English insect was introduced into America at Long Island no longer ago than in 1860, and has already proved so destructive that, in one year, in the State of New York alone, the loss to gardeners from the damage done to asparagus-beds was estimated at 50,000 dollars. The *Galeruca calmariensis*, which devours the foliage of the elm, is another beetle of the same tribe acclimatized in North America from Europe. It may fairly be urged, if these characteristic European species have become acclimatized and destructive in North America, what valid ground is there for supposing that the potato-beetle, so nearly allied to them in organization, will be unable to establish itself in Europe.

In answer to this, it may be stated, in the first place, that the establishment of European species in other distant countries, as all botanists and zoologists well know, is not reciprocated to the same extent by the acclimatization of foreign species with us. Many of our commonest plants and insects have followed our colonists even to the antipodes; and in New Zealand, especially, they threaten to crowd the native species out of existence; but no antipodean natives have made the reverse migration. This curious fact has been accounted for by supposing that European organisms of the lower types have, like the European man, become so invigorated by repeated readjustments to the greater geological and climatal changes of past ages, which our continent has witnessed, that they have become more encroaching and more successful under new circumstances than the natives of most other regions. It is difficult to see how this argument can apply in comparing the biological conditions of North America and Europe; but the fact nevertheless remains that, so far, North American species have not sent colonies to Europe in anything like the same proportion as European species have with regard

to North America; and it must be repeated, that no North American beetle has yet naturalized itself on this side of the Atlantic.

A more valid argument may be founded on the evident special adaptation of the potato-beetle, and the group of species to which it belongs, to the region in which they have been hitherto confined. In the natural distribution of the genus, the group is quite unknown beyond a circumscribed area, and that area marked by peculiar continental conditions of climate, namely, the interior of the North American Continent. It is well known to naturalists that the species of all large genera fall into minor groups, closely allied in their organization, and always strictly confined to definite minor geographical areas. No explanation can be given of this law other than that the groups so formed have become specialised to a high degree, with close reference to the conditions of the area which they inhabit. Such species are never cosmopolitan wanderers, like those of genera which show a looser adaptation to their *locale*. It will readily be granted by entomologists that the potato-beetle group shows this restricted adaptation in a remarkable manner. Two out of three of its closely allied species belong to elevated plateaux in the interior of the continent, and tend in their range towards the tropics rather than towards the north. The potato-beetle itself is found as far South as the city of Mexico, at an altitude of 5000 feet, and its nearest relative (a species with difficulty distinguishable from it), the *Doryphora* 11-*lineata*, is confined to Mexico, and the country next to the South—Guatemala. A third species, *D. juncta*, is known only in the middle States, from Georgia to Southern Missouri. No species at all approaching this group in natural affinity is found inhabiting Europe, or any part of the world other than the warmer temperate and tropical regions of the American Continent. It is quite otherwise with the two European beetles of the same tribe which have naturalised themselves in the United States, viz., the asparagus-beetle and the elm-leaf eater, the latter having numerous North American native relatives, and the former belonging to a group which ranges over the world, though curiously enough represented in North America by Mexican species only. If it be objected that the potato-beetle, though originally restricted to a peculiar region, has departed from the habits of its group, and developed a powerful migratory instinct, the answer is that in spreading it has kept very closely to a tract of country possessing a similar climate to that of its native home—the climate of the States invaded being characterised by the same hot fine summer, and cold dry winter, during which latter the ground is always protected by a coating of snow, an essential condition to a creature which

hybernates a few inches below the surface of the soil. Although it is true that the zone of country now occupied by the beetle has the same mean annual temperature (50°) as the South of England, yet the summer and winter temperatures are widely different, the mean temperature for July in these parts of America being 72°, and for January 32°; whilst in the South of England, it is 63° and 40° respectively for the same months. The more uniform humidity of North-Western Europe throughout the year is also an element to be taken into consideration. The effect of this wide climatic difference is strikingly shown by the different course of the generations of those native European species which are nearest allied to the potato-beetle, *i.e.* the *Chrysomelæ.* These agree with the American insect in hybernating in the adult or beetle state, and awakening in spring to feed on their respective plants, and propagate their kind; but they differ in having only one generation during the season, instead of three, and in their much lower fecundity, the females laying from 30 to 60 eggs only in each generation, whilst the potato-beetle lays from 1000 to 1200. All doubts respecting this disputed point have been set at rest by Mr. Daniels, of Wisconsin, who recently obtained 1200 ova from one individual. It is an incredible supposition that a species of insect adapted to climatic conditions so entirely different, and presenting physiological features so incompatible with the influences it would encounter in Europe, could ever become acclimatised here. An important fact in confirmation of this view is supplied by a Report recently published by Lieut. W. L. Carpenter, of the United States Geological Survey, of his investigations in 1873, namely, that the beetle has not yet passed to the west of the Rocky Mountains. "Not a single specimen," he says, "has been seen west of the dividing ridge." It has, therefore, not yet faced the adverse climatic conditions of the Pacific coast, which nearly resemble those of Western Europe. It is right, however, to add, that Lieut. Carpenter believes it probable the insect will ultimately make its appearance in that region.

Thus, even if we give all due weight to the great adaptability to new conditions which the beetle has shown during its progress over half the American Continent, it seems an untenable assumption that it can carry this so far as to establish itself in Western Europe. If it should do so, it would be an unprecedented case, and falsify all previous experience. Certainly the creature has developed an extraordinary flexibility of constitution and habits since it left its quiet home in the Rocky Mountains, and we cannot be quite sure what it will eventually do. We hear, for instance, of its attacking thistles after clearing the potato-fields! It enters hot-houses and devours all the tender tomato and egg-plants. Most of the wild species of *Solanum* are pounced upon

wherever it goes, and it has fallen upon the black henbane (*Hyoscyamus niger*), the cabbage, and even grasses. Worst of all, it appears to have acquired a taste for the potato-tuber itself. A correspondent of Mr. Maclachlan, the Treasurer of the Entomological Society of London, writing a few months ago from Pueblo, in Colorado, says that he found on opening his potato-pits last winter several tubers wholly or partially destroyed by the beetles, and that he detected them in the act. The habit of eating tubers or fruit, or any other part of a plant except the leaves, is entirely unknown in any other species of the family to which this voracious creature belongs.

Although it may be taken as highly improbable that the pest will ever make a permanent home in the potato-fields of Britain, it is possible that a few stray specimens may arrive. But the details given above of its habits and transformations will show how unlikely this is to occur without speedy detection. It is not likely to be conveyed in the egg-state, as the eggs are not concealed, but laid on the outside of the leaves, and are quickly hatched; neither can the pulpy larvæ, which take only seventeen days to complete their growth, and cannot live two days without a continuous supply of fresh leaves, be carried so far; nor the fragile pupa, which changes to the perfect insect in ten days. Dr. Fitch, State Entomologist of New York, who often received parcels of the living insect from the Western States, found always the earlier states dead or crushed, whilst the adult beetles bore the journey perfectly well. It is only the arrival of the perfect beetle, then, that may be considered possible. This might happen at any time during the summer, through the medium of any vessel arriving from American ports where the insects are flying about. Mr. Riley put this very clearly when he said, in one of his earlier Reports, that whenever the streets of New York in summer should swarm with the beetles as those of St. Louis had done, it would be exceedingly likely that some of them, pregnant females included, would alight on outward-bound vessels in the port, and get conveyed to Europe. Mr. Riley himself now brings us the news that this summer the beetles *are* swarming in the shipping quarter of New York. If a few should get concealed among the cargo, especially in the early autumn, when they begin to look out for a snug place wherein to lie dormant, the probability of their safe conveyance will be increased. We are assured, indeed, by Professor Lawson of Nova Scotia, that for the past two or three years it has been impossible in many ports of North America to pack up any kind of produce without potato-beetles getting into it, and that he knows for a fact that numbers have been so sent to England. The possibility of living specimens arriving here cannot, therefore, be disputed; but I hold that the facts and analogies of the

case supply ground for confidently believing that there is exceedingly little probability of their propagating and spreading in this country. The climate of Southern and Central Europe is more akin to that of the native country of the beetle, and in those regions the risks are somewhat greater.

The chances of the insect arriving concealed in bags or casks of potatoes are very slight. American potatoes are imported into Britain only for seed purposes, and in remarkably clean condition. Newly-arrived casks which I saw opened at Messrs. Carter's, High Holborn, contained not a particle of refuse, and no pellet of soil large enough to conceal a hybernating beetle; and I was assured that this was their usual state. Many of these seed-potatoes are very costly, some ("Eurekas") being worth as much as twelve shillings a-pound. The total imports from America for several years past have been very moderate, the high freight preventing their importation for food purposes. According to a Customs Return, with which I have been favoured by the Board of Trade, on the application of Mr. Jenkins, Secretary to the Society, the quantities for the past five years were as follows:—

Year.	Cwts.
1870	490
1871	1166
1872	2716
1873	2832
1874	1056

Nearly the whole of these amounts were shipped at New York, a very small proportion being from Philadelphia, Boston, Portland, and Norfolk; and the ports of arrival were in the following order:—Liverpool (about two-thirds of the whole); London (about one-third); while Cardiff, Glasgow, Portsmouth, Bristol, and Londonderry received only very small quantities. The shipments have always arrived in the winter and early spring months, the returns being nearly blank for the months between May and September inclusive. The exported tubers, in fact, are not taken from the ground in America until all the eggs and larvæ have disappeared, and the last brood of beetles has commenced hybernating beneath the surface. There is a chance, of course, of some of the late and sluggish beetles finding their way into the casks or sacks with the potatoes; but it is the only risk, and is not nearly so great as that of the conveyance of the insect by the other means already mentioned. To prohibit the importation of potatoes with the view to excluding the pest, as has been done by the countries previously mentioned, is, therefore, a most childish policy.

XIV.—*Report on the Results of the Competition of* 1874 *for the Society's Prizes for Potatoes that should be free from Disease for three years in succession.* By WILLIAM CARRUTHERS, F.R.S., Consulting Botanist to the Society.

THE ignorance prevailing in regard to the true nature of the plague which for thirty years has been so destructive to our potato crop was singularly manifested to the Judges who undertook the task of adjudicating the prize offered by Lord Cathcart in the autumn of 1872, for the best essay on 'The Potato Disease and its Prevention.' The ninety-four competing essays were written, with very few exceptions, by practical men —growers of potatoes—but only a small proportion showed any acquaintance on the part of the authors with the agent which destroyed the potato. Unable to advise the bestowal of the prize on any of the competitors, the Judges, considering the importance of the subject, the renewed attention given to it, and the defects in our knowledge of the parasite causing the disease, resolved to recommend to the Royal Agricultural Society to take the matter up as a subject of investigation, in the hope that some genuine addition to knowledge might be made, and some practical hints for the future guidance of cultivators might be secured.

The Society, approving of this recommendation, resolved to promote investigations as to the more strictly scientific aspect of the subject. They entered into correspondence with Professor De Bary, whose important additions to the knowledge and history of the potato fungus, and whose elaborate memoir of the group to which it belongs, pointed him out as the fittest botanist to undertake this part of the work. Professor de Bary has cordially entered into the Society's plans; and has now for some time been carrying on experiments and observations with the view of determining those points in the history of the parasitic fungus which are yet unknown. When his work is completed the result will be published in the Society's Journal.

The Society further resolved to look at the subject in its practical bearings on the agriculturist, and endeavour to gain facts from the past experience of potato-growers, and from experiments to be instituted, which might concur with the more purely scientific investigations to a definite apprehension of the potato-disease in all its bearings. A series of questions were accordingly addressed to extensive potato-growers throughout the United Kingdom; the answers have been digested by Mr. Jenkins, and published in his Report on the subject in the last volume of the Society's Journal (pp. 475–514). It is there

pointed out that in two cases where potato crops followed turnips they had been free from disease; and having suggested that the fungus might pass through different stages of its life on different plants, Mr. Jenkins proposed that observations should be made to discover if any connection existed between the previous cereal or clover-crop and the presence or prevalence of the disease. Dr. Farlow, Assistant-Professor of Botany at Harvard University, U.S., in a recently-published Report on 'The Potato Rot,' has recommended the farmers of America to make observations in the directions indicated by Mr. Jenkins, with the view of supplementing those recorded in England.*

Still further, it having been asserted by many that certain varieties of potato were free from disease, and this opinion being believed by many cultivators as well as dealers, the Society resolved to offer prizes for early and late potatoes, possessing good cropping, cooking, and keeping qualities, which would continue free from disease for three years, during which time they would be cultivated in different localities under the direction of the Society. It was required that the competitors should forward a ton of each sort intending to compete in twenty bags containing each one cwt. To prevent any but those who had some confidence in their potato entering as competitors, it was required that the owner of any sort which should be attacked by disease during the experiment should undertake to pay a considerable sum towards the expense incurred in growing his unsuccessful potato, although this condition was not eventully put in force.

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* Connected with Harvard University is an endowed institution for the investigation of cryptogamic plants—the Bussey Institution. The fourth part of the first volume of the reports of this Institution has just been published containing Dr. Farlow's memoir, from which we make the following quotation.

"Prof. De Bary of Strasbourg—whose memoir of the *Peronosporeæ*, published in the 'Annales des Sciences Naturelles,' vol. xx. 1863, is the most exhaustive account of that group yet published—is still at work, and from him we may receive a solution of the botanical difficulties. In the meanwhile, the American farmer can contribute something to the general stock of knowledge by noting the apparent effect which a different succession of crops has upon the prevalence of the rot. In the 'Journal of the Royal Agricultural Society of England,' vol. x. Part 2, for 1874, are given the results obtained from answers to twenty-five questions, addressed to one hundred potato cultivators in different parts of England. From these answers it would seem that there is a tendency for the rot to prove particularly bad when potatoes follow clover. Interesting facts on this point might be observed by our own cultivators to supplement those recorded in England, and we would propose the following questions for the consideration of farmers in connection with the rot:"—Then follow eleven questions similar to what were sent out for Mr. Jenkins' report, the last two of which are, "10. Following a clover crop, how are potatoes affected by the rot, particularly badly or not? After potatoes does clover do well? Have you observed any fungus upon clover? 11. Following a wheat, oat, or rye crop, how are potatoes affected by the rot? When wheat, oats, or rye follow potatoes, what is the result?"—'Bulletin of the Bussey Institution,' vol. i. Part. iv., pp. 331, 332.

Before the end of February, 1874, six varieties of potatoes had been delivered to the Society's agent to compete for the prizes, two being early and four late varieties. They were as follows :*—

Early Potato, No. 1.—Wheeler's Gloucestershire Kidney. This was raised from seed in the neighbourhood of Bristol about twelve years ago, but it is not known by whom. Its owners consider the special features which distinguish it to be freedom from disease, earliness, and good size and colour; it has also a fine flavour, and is a good keeper and an excellent cropper. The competitors are J. C. Wheeler and Son, Gloucester.

Early Potato, No. 2.—Carter's Ash-Top Flukes. This was raised from seed by the competitors about five years ago, and is characterised by them as being early, very productive, a good boiler, and remarkably free from disease. The competitors are James Carter, Dunnett, and Beale, London.

Late Potato, No. 3.—Carter's Improved Red-Skin Flour Ball. This was selected by the competitors in 1871 from a variety called "Champion of England," raised by Mr. Barkshire of Reading, and is characterised by its owners as being prolific, white fleshed, and remarkably free from disease. The competitors are James Carter, Dunnett, and Beale, London.

Late Potato, No 4.—General Grant. This was raised by Mr. D. Cunningham, of Athy, Kildare, from a few tubers which he received from America. Its special features, according to the competitors, are that the shaws keep green when other varieties are blackened, the tubers are large and well formed, and it is the only late variety which resists disease. The competitors are Thomas M'Kenzie and Sons, Dublin.

Late Potato, No. 5.—Gleason's Late, or Hundredfold Fluke. The origin of this potato is not known, further than that it was imported by a potato salesman in 1870. The competitors characterise it as having the haulm robust, branching, about 2½ feet in length; stem of a reddish tinge; leaflets flat-pointed, green with coloured veins; flowers purple, generally sterile; tubers large, generally broad, flat, sometimes irregular in form, as if two or three were joined together; eyes few and full; skin smooth, very pale, with large bands or patches of rosy purple; flesh white and rather hard: it is, though late, a good average cropper. The competitors are James Carter, Dunnett, and Beale, London.

Late Potato, No. 6.—Peach Blossom. This potato was raised by the competitor from tubers received in 1869 from New York.

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* The numbers used for the different competing potatoes in this Report are not those employed in the experimental plots.

It is characterised as a good prolific potato, and without disease during the four years it has been grown in this country. It is not ripe for use until November or December. The competitor is Baron Middleton, Boisdale House, York.

The Committee fixed on twenty localities in which to grow these experimental potatoes, selecting them in districts where potatoes are extensively cultivated, and securing as far as possible as great a variety of climate, soil, and method of cultivation as could be obtained within the United Kingdom. The hearty co-operation of the following gentlemen practically interested in the culture of the potato in these various districts was obtained. They undertook to grow a cwt. of each of the six kinds of competing potatoes:—

1. *Kent.*—Mr. Robert Lake, Oakley, Higham, Rochester.
2. *Essex.*—Mr. Richard Spencer, Brooklands, Birchanger, Bishop's Stortford.
3. *Bedfordshire.*—Mr. G. J. Cocking, College Farm, Bedford.
4. *Staffordshire.*—Mr. John Brawn, Sandhills, Walsall.
5. *Lincolnshire.*—Mr. J. Algernon Clarke, Long Sutton.
6. *Yorkshire.*—Capt. R. S. Best, Moorfields, Goole.
7. *Northumberland.*—Mr. John Angus, Whitefield, Morpeth.
8. *East Lothian.*—Mr. Samuel D. Shirreff, Saltcoats, Drem.
9. *Perth.*—Colonel Ogilvy, Mill Hill Farm, Inchture.
10. *Elgin.*—Mr. Thomas Yool, Coulard Bank, Elgin.
11. *Exeter.*—Mr. John Daw, Exeter.
12. *South Wales.*—Mr. W. S. Powell, Eglwysnunydd, Taibach.
13. *North Wales.*—Mr. John Roberts, Well House Farm, Saltney, Chester.
14. *Lancashire.*—Mr. Richard Simpson, Out Rawcliffe, Garstang.
15. *Cumberland.*—Mr. Thomas Gibbons, Burnfoot-on-Esk, Longtown.
16. *Ayrshire.*—Mr. Robert Wallace, Braehead, Ayr.
17. *Munster.*—Mr. A. J. Campbell, Fermoy.
18. *Connaught.*—Mr. John Nesbitt, Garbally, Ballinasloe.
19. *Leinster.*—Mr. J. A. Farrell, Moynalty, Co. Neath.
20. *Ulster.*—Miss Rose, Mullaghmore, Monaghan.

These various growers were supplied with instructions as to how the experiment should be conducted. They were requested to plant the competing potatoes in adjacent plots in the same field with their own potato crop, keeping each sort distinct, and submitting all to the same treatment as their ordinary crop. Each cultivator has, in answer to a series of questions, supplied information as to whether his district is open or wooded, and has much hedge-row or other timber on the land; as to the soil, subsoil, drainage, and slope of the particular field in which the potatoes were growing; as to the previous cropping of the field; the kind of potato forming his general crop; the processes followed in preparing the land for the potatoes, including a statement of the manure employed, the distance at which the seed-tubers were planted, and the quantity planted in relation to the

space occupied. These different items of information have been brought together in a Table, so that the different methods may be easily compared and contrasted (see page 384). Information has also been obtained as to the after-cultivation of the crop, and the monthly appearance of the experimental plots and the general crop. A book was prepared and forwarded to each grower for recording these matters. This book also contained a calendar for a daily record of the weather. With a single exception * these books have been kept with great care, and from them has been derived the greater proportion of the facts contained in this Report.

The Committee requested me to inspect all the plots while the potatoes were growing. Between the 27th July and the 4th September I accordingly visited all the localities; beginning in the south of England, and travelling northwards until I reached Lancashire, then crossing to Ireland, and after inspecting the four plots there, returning again to the north of England, and prosecuting my journey northwards till I finished at Elgin.

The Committee further secured the assistance of five gentlemen to be present on behalf of the Society at raising the crops, to superintend the operations, and determine whether the disease had attacked any of the tubers, and if it had, to determine the extent of the injury. Professor Baldwin, of Glasnevin, undertook this work for Ireland; Mr. Thomas Mylne, of Niddry Mains, Edinburgh, for Scotland; Mr. W. H. Wakefield, of Kendal, Westmoreland, for the north-west of England; Mr. Jabez Turner, for the east and north-east; and myself for the southern districts. Instructions were given to these Judges to have all the potatoes attacked with the disease separated from the others, and to weigh the produce in the field. They were to record in a schedule, with which they were provided, the weight of healthy potatoes in each plot, of diseased ones, the size of each plot, and the rate of produce per acre. They were asked to supply also the same information about the general crop in each farm, and to record any observation which might be of interest in connection with their inspection. These Reports were all duly made. The whole of the potatoes were packed, the healthy and diseased tubers of each plot being kept separate and carefully labelled. They were then dispatched to London, and received at the Agricultural Hall, where, by the courtesy of the Directors, they were for some time accommodated.

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* The potatoes in the experimental plots at Garbally, Ballinasloe came up so badly that Mr. Nesbitt unfortunately laid aside his book, thinking it would be unnecessary to keep the record.

This Report is based on the books kept by the growers, on the notes made by myself in the course of my inspection of the growing crops, and on the Reports of the Judges who were present at the raising of the crops.

The six tons of competing potatoes (each ton in twenty equal sacks containing one cwt. each) were received in London in the end of February 1874, and were dispatched to the various growers in the first week of March.

When the bags were opened at their destination the growers found in some instances that a few of the tubers were rotten. They probably suffered to some extent from careless treatment in their transit to London, and from London to the different localities where they were to be grown. Mr. Campbell, of Fermoy, who carefully examined the tubers and separated any rotten specimens from the sound ones, believed the injury was due rather to frost and bruises sustained in transit than to disease. His opinion is confirmed by his interesting observations on the growth of the potatoes. He counted all the setts which he planted, and afterwards the number of plants which grew in the drills. The results are shown in the following Table :—

Table I.—Showing the Number of Setts Planted and Plants that grew, in the Experimental Plots on Mr. Campbell's Farm at Fermoy.

No.		Setts Planted.	Plants Grew.	Percentage of Growing Plants.
1	Early	1530	303	19·8
2	„	1969	173	8·7
3	Late	1410	457	32·4
4	„	1107	474	42·8
5	„	1065	517	48·5
6	„	1665	1115	66·9

These figures clearly show that a further injury had befallen the potatoes than the careful inspection to which Mr. Campbell subjected them was able to detect. I am satisfied that no tuber attacked by disease or suffering from ordinary rot escaped him. But some hidden injury was present, such as might be the result of the exposure of the tubers to a severe frost. Yet that this injury, whatever it was, was not entirely produced during their

transit from the competitors' premises to the growers is manifest from the fact that in all the experimental plots the No. 2 early potato showed numerous blanks, and that the failures of the seed-potatoes of the other varieties were everywhere approximately in the same order as at Fermoy. The short journeys to the neighbourhood of London, as to Kent, Essex, and Bedford, of seed that had been stored in London, would of course save it from the injuries and dangers incident to a lengthened journey, like that to Ireland, with its repeated transhipments. We have fortunately a series of similarly extensive and careful observations by Mr. Spencer, of Essex. He examined the seed, separating each bag into three lots: 1, the healthy tubers of the particular variety; 2, the healthy tubers of sports, accidentally introduced among the true seed; and 3, diseased tubers. In all of the competing varieties, except in No. 6, he discovered tubers, more or fewer, which were, he believed, affected by the disease. Mr. Simpson, Lancashire, detected also apparently diseased tubers in the seed of No. 2 early, and No. 4 late. The results of Mr. Spencer's observations as regards the germination of the seed-tubers are thus tabulated:—

TABLE II.—Showing the NUMBER of SETTS PLANTED and of PLANTS that grew, in the EXPERIMENTAL PLOTS on MR. SPENCER'S FARM, ESSEX.

No.		Good Setts Planted.			Plants Grew.	Percentage of Growing Plants.
		True.	Sports.	Total.		
1	Early	1031	..	1031	1020	98·9
2	"	1107	..	1107	751	67·8
3	Late	553	21	574	539	92·1
4	"	512	18	530	457	86·2
5	"	655	11	666	652	97·9
6	"	657	1	658	646	98·1

The tubers believed to be diseased were planted at the end of each lot. When the injury to the tuber had not been so great as to kill the eye or bud and destroy the starch-food needed for the germination of the bud, these tubers grew, and were, when I examined them on the 28th July, all perfectly free from disease. A large proportion, however, did not grow, as shown by the following Table:—

TABLE III—Showing the NUMBER of apparently DISEASED SETTS PLANTED and of PLANTS that grew from them, in the EXPERIMENTAL PLOTS on MR. SPENCER'S FARM, ESSEX.

No.		Diseased Tubers Planted.	Plants Grew.
1	Early	6	0
2	„	75	3
3	Late	14	5
4	„	6	3
5	„	2	0
6	„	0	0

I learned from Mr. Spencer that he had in previous years experimented with diseased seed-tubers with the view of determining the relation of their products to the disease; and he had observed that the plants grown from them were not more liable to be attacked by the disease, or to suffer from it, than those grown from healthy tubers. The aspect of the eleven plants, when I visited the experimental plots in Essex in the end of July, corroborated Mr. Spencer's conclusions. This is of considerable value in relation to the yet unsolved question as to how the fungus causing the disease maintains its existence from the autumn to the following July or August, when under favourable circumstances it suddenly appears and spreads with wonderful rapidity. It rather tells against the opinion that the life of the fungus is maintained by planting diseased tubers; for instead of the disease appearing first in the plants produced from them, these plants suffer only along with, and in the same proportion as, their neighbours produced from healthy seed. On the other hand, it must be remembered that if the mycelium of the parasitic fungus developes in a single plant grown from a diseased tuber, and this mycelium fructifies, the enormous mass of seed which is rapidly produced and reproduced under suitable conditions, would fully explain the spread of the disease. We look forward with much hope to the observations and experiments that Professor De Bary is now prosecuting for light on this obscure part of the history of the potato fungus.

In the stations in the south and east of England, and the south of Ireland, all the seed-tubers were in the ground before the close of the month of March; in the north and west of England, in Scotland, and in the north of Ireland, they were all planted before the middle of April.

The information obtained from the growers, or observed during

my visit to the different localities where the crops were growing, as to the nature of the soil, previous cropping, the preparation of the land, the manure, and the time and manner of planting the seed, will be best appreciated in a tabular form, where the eye can readily compare and contrast the various data given.

In the Table opposite (IV.) I have arranged the localities from south northwards, first on the eastern side of the United Kingdom, and then in the same order on the western side. The two groups into which the localities are thus separated are distinguished by the difference in the amount of annual rainfall, as shown in the first column. The data for this column must be considered as approximate for the particular locality, being obtained from the published reports of the nearest meteorological stations. The distribution of the localities secured, as will be observed, a good representation of the different meteorological conditions occurring in Britain. The various kinds of soil, too, were fairly represented, as well as the variations in cropping, and in the treatment of the potato crop practised by agriculturists.

The season of 1874 was dry up till the end of July and the beginning of August, when frequent and sometimes heavy rains occurred. In the progress of my inspection of the crops I met with no disease till I passed over to Ireland. Thereafter, throughout Ireland and Scotland, and the north of England, I found the experimental crops diseased, except in Northumberland and East Lothian. At Elgin some of Mr. Yool's general crop was affected by disease, but I was unable to detect any among the experimental plots, though it was found to be present in three kinds when the potatoes were raised, but then only to a very small extent.

The disease appeared suddenly in Ireland, and spread with its wonted rapidity. In a few days after its appearance the fields in the south and west of Ireland were black. I visited Fermoy (Munster) on August 15th. The crops had been progressing satisfactorily till the beginning of the month. Until July 26th there had been no rain on the field in which the potatoes were growing since they were planted, but on that day there was a heavy shower, and showers occurred during several succeeding days. On August 4th the leaves of all the experimental crops, as well as of the regular crop, showed here and there the presence of disease; and on the 15th I found that it had reached the tubers in some cases. When I reached Ballinasloe (Connaught), on the 17th, the extent of the injury from disease was greater. The field in which the potatoes were growing had been recently reclaimed from bog, and was almost a black peat. The whole of the plants were remarkably vigorous, but the foliage was extensively diseased, and the tubers were also affected. The early

Table IV.—Showing the Nature and Preparation of the Land, the Manure, the Seed, &c., in the Various Localities.

	Annual Rainfall in Inches.	1. Country Open or Wooded.	2. Timber.	3. Soil.	Subsoil.	4. Land. Level or Sloping.	Aspect.	5. Drains.	6. Cropping of 1870.	1871.	1872.	1873.	7. Potatoes last Grown.	8. Preparation of Land.	9. Manure.	10. When Planted.	11. Seed per Acre. 1	2	3	4	5	6	12. Seed. Cut.	Uncut.	13. Width of Drill.	14. Distance of the Setts. 1	2	3	4	5	6	15. General Crop.
1. Kent	20	Open	None	Sandy loam, good quality.	..	Easy slope	E.	Not needed	Swede Turnip for seed.	Wheat	Clover	Wheat	1863	Broadshared and harrowed in Autumn Baulked up deeply in October, baulks split in Feb. Harrowed down and ploughed March. Dressed and struck in March 30.	½ ton Odam's Potato Manure, *March 30*	March 31	7½	7	9½	11½	8	7½	Lates	Earlies	Inches. 24	17	17	20	18	21	20 Inches.	Dons.
2. Essex	25	Open	None	Gravelly clay	Chalk	Sloping	E.	Not needed	Barley	Barley	Clover	Wheat	Never	Ploughed in December Ridged up in March.	8 tons farmyard, *March 24* 4 cwt. Superphosphate, *ditto.* ½ cwt. Nitrate of Soda, *ditto.*	March 24	General Crop 9 cwt.						Some whole Some cut.		33	About 24 inches						Regents.
3. Bedford	27	Open	None	Loam	Gravel	Level	..	Not needed	Potatoes	Wheat	Clover	Onions	Not known	Ploughed in Autumn " March.	70 bushels Soot, *End of February*	March 29	About 9 cwt.						Some whole Some cut.		27	15 inches						Scotch Regents.
4. Stafford	30	Open	Very little Few hedgerow trees.	Sandy loam	..	Level	..	None	Mangold	Potatoes	Barley	Clover	1871	Ploughed 21st March	25 tons farmyard, *End of March*	March 28	15	15	33	27	20	23	Some whole Some cut.		22	12 to 15 inches						Red-skin Flour-ball.
5. Lincoln	25	Open	None Few trees.	Alluvial loam.	Silt	Level	..	Thorn drains 2½ ft. deep.	Wheat	Potatoes	Wheat	Barley	1871	Ploughed in September Ridges opened in February.	10 tons of farmyard, *March 19* 6 cwt. of Langdale's Superphosphate, *do.*	March 19	About 13 cwt.						Some whole Some cut.		28	About 14 inches						Scotch Regents.
6. York	25	Open	None	River silt	Peat	Level	..	3 ft. deep 40 ft. distant.	Potatoes	Potatoes	Wheat	Flax	1871	Ploughed in Autumn and harrowed Ploughed in November. Ridged in February.	15 tons farmyard, *Autumn* 15 cwt. Guolo and marsh land pure tillage, *March 21.*	March 21	12 cwt.						Lates	Earlies	28	About 14 inches						York Regents.
7. Northumberland	25	Open	None	Free soil, stony	Sandstone	Level, scarcely sloping.	S.E.	3½ ft. deep distance irregular.	Swedes and Cabbages.	Barley	Clover	Oats	About 1860	Ploughed in Autumn, 8 inches Ploughed in April. Grubbed, rolled, harrowed in April.	20 tons farmyard, *April 21*	April 21	Early 13 cwt. Late 14½ cwt.						Lates	Earlies	29	12 inches			11 to 14 inches			Scotch Regents.
8. East Lothian	24	Open	None	Free soil	Clay	Almost level, scarcely sloping.	S.	3½ ft. deep 36 ft. distant.	Hay	Oats	Potatoes	Wheat	1872	Ploughed in December, 9 inches Harrowed and grubbed in March. Ridged beginning of April.	25 tons farmyard 9 cwt. { 4 cwt. Guano. 2 cwt. Coprolite Superphosphate 1 cwt. Nitrate Soda. 2 cwt. Cotton-cake Seed. } Top-dressing 1 cwt. Nitrate, *April 2.*	April 2	About 12 cwt.						Lates	Earlies	30	13 inches						Regents.
9. Perth	25	Open	Not much	Black loam	..	Sloping	S.W.	Partially drained long ago; depth and distance not known.	Grass for Hay.	Grass for	Pasture	Oats	Not known	Ploughed in December " March, and harrowed and rolled. Ridged in middle of April.	15 tons farmyard, *April 16* 5 cwt. dissolved bones, *ditto.*	April 16	From 12 to 14 cwt.						Lates	Earlies	28	Cut setts 12 to 13 inches. Uncut setts 15 inches.						Regents.
10. Elgin	25	Open	None	Sandy loam	..	Level	..	Drained long ago; depth and distance not known.	Turnips	Barley	Grass for Hay.	Oats	1868	Dunged on surface and ploughed in Autumn Cross-ploughed and harrowed 25th March.	15 tons farmyard, *Autumn* 2 cwt. Kainit, *March 25.* 1½ cwt. Nitrate Soda, *April 9.* 3¾ cwt. dissolved Phosphate Guano, *ditto.*	April 9	About 13 cwts.						Lates	Earlies	27	About 12 inches						Dalmahoy's, Rogents, and Paterson's Victoria.
11. Exeter	35	Open	None	Clay loam	Stiff clay	Sloping	N.	4 ft. deep 25 ft. distant.	Clover	Oats	Mangold	Wheat	Not known; not for 20 years.	Ploughed in Autumn	2 cwt. Nitrate Soda, and 3 cwt. dissolved bones, *a fortnight before planting.*	April 8	6 cwt. by error						Lates	Earlies	48 by error.	Far apart by error						Lapstones—King of Earlies — Dalmahoy's, &c.
12. South Wales	40	Open	None	Light loam	Gravel	Slightly sloping.	S.W.	3½ ft. deep	Wheat	Mangold	Wheat	Turnips	Not for 20 years.	Ploughed in October for vetches which failed Ploughed, harrowed, and rolled twice in March. Ridged in end of March.	20 tons farmyard, *Nov.* 3 cwt. Superphosphate, *with the seed.* 2 cwt. Kainit, *ditto.* 1 cwt. Sulphate Ammonia, *ditto.*	March 30	20	20	20	20	40	20	Lates except No. 3.	Earlies and No. 3 Late.	24	11 to 14 inches						Paterson's Alexandras, Queen, and Alberts.
13. North Wales	35	Open	None	Loam more or less sandy		Level	..	1½ ft. deep	Beans	Wheat	Grass	Oats	1866	Steam ploughed in October Cultivated three times in March and April, with the usual harrowing and rolling between.	19 tons farmyard, *Autumn* 3 cwt. Prostar and Ryland, *when planted.*	April 15	About 15 cwt.						Lates	Earlies	28	12 inches			18 inches			Paterson's Victoria.
14. Lancashire	40	Open	None	Peat	Clay	Level	..	3 ft. deep 24 ft. distant.	Oats	Potatoes	Wheat	Clover	1871	Ploughed very lightly in December Harrowed until a fine mould in March. Ploughed in March 7 inches. Harrowed. Ploughed across in April. Ridged in April.	16 tons farmyard, *when planted* 4 cwt. Artificial Manure, *ditto.*	April 21	About 23 cwt.						Some whole Some cut.		28	About 12 inches						Pink Flukes.
15. Cumberland	30	Open	Very little	Alluvial	Porous subsoil	Level	..	None	Oats	Grass	Grass	Oats	Not for 20 years.	Ploughed in November " March. Cultivated before planting.	12 tons farmyard, *April 24*	April 24	No answer						Lates	Earlies	32	Cut setts 12 inches Uncut setts 16 inches.						Walker's Regents and Rocks.
16. Ayr	40	Open	None	Loam	Clay	Sloping	S.	3½ ft. deep 24 ft. distant.	Seeds	Pasture	Pasture	Oats	1868	Subsoiled and ploughed in winter Twice grubbed in March. Harrowed and ridged in April.	30 tons farmyard, *when planted* 4½ cwt. Guano, *ditto.*	April 11	5	5	5	8	5	5	All	..	27	14 inches						Red bogs, Dons, and Victorias.
17. Munster	40	Open	Very little	Loam	Stiff, resting on limestone.	Level	..	Not needed	Pasture	Pasture	Pasture	Oats	Not for 20 years.	Ploughed in October Turned over in March. Harrowed, handpicked, and ploughed in March.	40 tons farmyard, *March 24* Top-dressed with 5 cwt. Superphosphate.	March 24	7	5	6	8	8	5	All	..	30	10 inches			12 inches			Yorkshire Regents, and Reds, and Lethercoats.
18. Leinster	30	Wooded	Plantation and hedgerow timber.	Clay	Sandy	Level	..	Not needed	Badly farmed for forty years				1861	Ploughed in broad ridges beginning of March Harrowed on 9th March. Marked for potato ridges 10 and 11 March.	12½ tons farmyard, *March 20* Top-dressing 4 cwt. Superphosphate and Kainit.	March 20	12½ cwt.						Lates	Earlies	15	18 inches						Scotchdowns, American Rose, Sutton's Red-skin, &c.
19. Ulster	40	Open	None	Light	..	Sloping	S.	Not needed	Pasture for twenty years				Not for 25 years.	Ploughed in October Ploughed, harrowed, and drilled in Spring.	22 tons farmyard, *when planted* 5 cwt. Burrell's Challey's Manure, *ditto.*	April 15	About 9 or 10 cwt.						Some whole Some cut.		36	About 15 inches						Flounders, Sutton's Red-skin, &c.

To face page 384.

TABLE V.—SHOWING the WEIGHT of HEALTHY and DISEASED TUBERS produced in each LOCALITY, with the Proportion the one bears to the other.

No.		No. 1, EARLY. Healthy.		Diseased.		Per-centage of Diseased.	No. 2, EARLY. Healthy.		Diseased.		Per-centage of Diseased.	No. 3, LATE. Healthy.		Diseased.		Per-centage of Diseased.	No. 4, LATE. Healthy.		Diseased.		Per-centage of Diseased.	No. 5, LATE. Healthy.		Diseased.		Per-centage of Diseased.	No. 6, LATE. Healthy.		Diseased.		Per-centage of Diseased.
		cwt.	lbs.	cwt.	lbs.		cwt.	lbs.	cwt.	lbs.		cwt.	lbs.	cwt.	lbs.		cwt.	lbs.	cwt.	lbs.		cwt.	lbs.	cwt.	lbs.		cwt.	lbs.	cwt.	lbs.	
1	Kent	7	30	0	1	..	6	94	0	1	..	10	67	0	5	..	9	82	0	2	..	9	52	0	1	..	8	77	0	3	..
2	Essex	7	56	0	2	..	3	12	0	6	1·7	11	95	..		..	7	64	..		..	9	26	..		..	9	82	0	50	4·5
3	Bedfordshire ..	3	29	One tuber		..	2	88	..		..	18	22	One tuber		..	12	35	..		..	9	76	...		..	6	74	..		..
4	Staffordshire ..	7	20	0	2½	..	5	46	0	10	1·6	19	61	0	1	..	10	105	0	9	..	9	27	0	0½	..	11	67	0	1	..
5	Lincolnshire ..	5	25	..		..	3	98	..		..	14	95	..		..	8	79	..		..	12	21	..		..	12	82	..		..
6	Yorkshire	5	61	..		..	4	7	..		..	14	63	Two tubers		..	10	81	..		..	10	72	..		..	10	4	One tuber		..
7	Northumberland	2	28	0	21	9·7	1	25	0	5	3·6	6	42	0	5	..	1	54	..		..	4	29	0	2	..	7	38	0	1	..
8	East Lothian ..	5	14	Trace		..	3	31	Trace		..	15	87	..		..	10	50	..		..	7	20	Trace		..	9	6	..		..
9	Perthshire	7	74	1	17	15·0	3	77	0	64	15·5	12	90	0	61	4·3	9	108	0	20	1·7	9	102	0	54	4·8	9	31	0	30	2·8
10	Elgin	4	101	Trace		..	2	58	Trace		..	12	98	0	15	1·0	9	0	..		..	8	88	..		..	7	51	..		..
11	Exeter	1	73	0	39	21·0	1	6	0	14	5·0	8	64	2	15	24·8	4	57	0	47	9·3	6	78	1	7	15·8	4	76	2	86	49·6
12	South Wales ..	2	82	0	68	22·2	1	42	0	38	21·6	7	15	1	18	16·2	6	7	0	91	13·3	2	84	0	47	15·2	3	78	1	74	44·9
13	North Wales ..	9	0	1	23	13·3	9	0	1	23	13·3	13	74	Trace		..	12	6	Trace		..	9	72	..		..	11	12	A few		..
14	Lancashire ..	3	79	0	56	13·5	1	12	0	10	8·0	4	8	0	20	4·3	1	60	0	10	5·8	5	73	0	10	1·5	4	56	0	30	5·9
15	Cumberland ..	2	52	0	70	25·3	1	35	0	34	23·1	7	32	0	42	5·1	5	40	0	20	3·3	7	88	0	42	4·8	5	17	0	21	4·1
16	Ayrshire	6	19	2	108	18·0	1	103	1	45	73·0	23	7	1	13	4·0	13	81	0	46	3·0	13	70	1	63	11·4	10	28	0	27	2·4
17	Munster	0	82	0	6	7·3	0	47	0	14	30·0	6	90	0	92	12·0	6	98	0	28	3·6	5	48	0	92	15·1	8	17	0	95	10·4
18	Connaught ..	2	43	0	56	22·0	2	36	0	56	21·5	8	9	1	89	22·2	3	31	0	39	10·6	5	48	1	53	27·1	2	110	1	50	43·5
19	Leinster	5	74	0	72	11·3	3	76	0	69	16·7	8	7	1	72	20·3	7	14	0	106	13·2	5	91	1	18	19·9	7	42	2	43	32·3
20	Ulster	10	17	0	43	3·7	7	42	2	43	32·3	7	36	0	23	2·8	10	8	0	16	1·4	7	47	0	57	4·4	3	59	0	2	..

TABLE VII.—Showing for each LOCALITY the TOTAL PRODUCE of the cwt. of SEED-TUBERS, the RATE per ACRE, and the PRODUCE per ACRE of the ordinary CROP of each GROWER.

(For continuation of Table VII. see below.)

No.	LOCALITIES.	Average Space of each Sett.	No. 1, EARLY. Produce of the Plot.		Size of the Plot.	Rate per Acre.			No. 2, EARLY. Produce of the Plot.		Size of the Plot.	Rate per Acre.			No. 3, LATE. Produce of the Plot.		Size of the Plot.	Rate per Acre.			No.
		Feet.	cwt.	lbs.	Poles.	Tons.	cwt.	lbs.	cwt.	lbs.	Poles.	Tons.	cwt.	lbs.	cwt.	lbs.	Poles.	Tons.	cwt.	lbs.	
1	Kent	3·17	7	31	12¼	4	15	7	6	95	12¼	4	5	105	10	72	9½	8	19	24	1
2	Essex	5·50	7	58	22¼	2	13	106	3	13	25	1	0	13	11	95	13	7	5	70	2
3	Bedfordshire	2·81	3	29	21½	1	4	72	2	88	21½	0	18	93	18	22	21½	6	15	5	3
4	Staffordshire	2·06	7	22½	10½	5	9	78	5	56	10½	4	8	90	19	62	5¾	27	0	80	4
5	Lincolnshire	2·72	5	25	11½	3	12	26	3	98	11½	2	14	28	14	95	9¼	12	16	83	5
6	Yorkshire	2·72	5	61	11⅓	3	19	50	4	7	1⅓	2	18	23	14	63	11⅓	10	8	73	6
7	Northumberland	2·62	2	52	14½	1	6	56	1	30	14½	0	13	71	6	47	12⅖	3	19	75	7
8	East Lothian	2·71	5	14	11½	3	11	34	3	31	12¾	2	1	13	15	87	12	10	10	40	8
9	Perth	2·52	8	91	11 3/10	5	17	66	1	29	13¾	2	10	88	13	89	11¾	9	5	0	9
10	Elgin	2·25	4	101	11	3	18	58	2	58	11¾	1	15	8	13	1	11 1/10	9	0	0	10
11	Exeter	..	2	0	30¼	0	17	63	1	20	29¼	0	12	4	10	79	31½	2	14	42	11
12	South Wales	2·08	3	28	8	3	5	0	1	80	8	1	14	32	8	33	8	8	6	0	12
13	North Wales	3·06	10	23	9¾	8	10	10	10	23	9¾	8	10	10	13	74	9¾	11	7	76	13
14	Lancashire	2·33	4	23	9	3	15	22	1	22	14½	0	13	41	4	28	5⅓	6	11	62	14
15	Cumberland	3·11	3	10	11⅓	2	4	29	1	69	11⅓	0	14	102	7	74	11	5	11	48	15
16	Ayr	2·62	9	15	17	4	0	80	3	36	17½	1	15	49	24	20	16¾	11	10	27	16
17	Munster	2·29	0	88	11 7/10	0	10	76	0	61	15	0	5	81	7	70	13	4	13	94	17
18	Connaught	..	2	99	12½	1	16	96	2	92	13⅓	1	16	72	9	98	16	4	18	63	18
19	Leinster	18·8	6	34	11½	4	9	73	4	33	13½	2	10	10	9	79	13½	5	15	3	19
20	Ulster	3·75	10	60	12½	6	11	21	9	85	15¼	5	2	43	7	59	12½	4	15	99	20
	Total	..	100	53	..	71	13	17	66	39	..	46	16	82	231	51	..	176	2	67	
	Average per Acre of the twenty Estimates ..	..	..		..	3	11	73	..		..	2	6	93	..		..	8	16	14	

Continuation of TABLE VII.

No.	LOCALITIES.	Average Space of each Sett.	No. 4, LATE. Produce of the Plot.		Size of the Plot.	Rate per Acre.			No. 5, LATE. Produce of the Plot.		Size of the Plot.	Rate per Acre.			No. 6, LATE. Produce of the Plot.		Size of the Plot.	Rate per Acre.			GENERAL CROP. Produce per Acre.			No.
		Feet.	cwt.	lbs.	Poles.	Tons.	cwt.	lbs.	cwt.	lbs.	Poles.	Tons.	cwt.	lbs.	cwt.	lbs.	Poles.	Tons.	cwt.	lbs.	Tons.	cwt.	lbs.	
1	Kent	3·17	9	84	7¾	10	1	32	9	53	11	6	17	88	8	80	11½	5	18	74	9	14	16	1
2	Essex	5·50	7	64	11½	5	3	97	9	26	14	5	0	64	10	20	14	5	15	76	7	16	23	2
3	Bedfordshire	2·81	12	35	21½	4	11	6	9	76	21½	3	6	49	6	74	21½	2	10	41	9	7	100	3
4	Staffordshire	2·06	11	2	4½	18	17	81	9	27½	5½	12	13	61	11	68	6¾	13	15	15	21	5	0	4
5	Lincolnshire	2·72	8	79	7¾	8	19	81	12	21	11½	8	9	63	12	82	11½	8	18	28	15	5	28	5
6	Yorkshire	2·72	10	81	11½	7	13	72	10	72	11½	7	12	54	10	4	11½	7	3	94	10	7	27	6
7	Northumberland	2·62	1	51	12½	0	18	44	4	31	12½	2	13	8	7	39	12½	4	11	21	No return			7
8	East Lothian	2·71	10	50	9¾	8	11	44	7	20	10	5	14	96	9	6	9¾	7	6	62	12	10	0	8
9	Perth	2·52	10	16	11½	7	10	7	10	41	11½	7	5	97	9	61	13 3/10	5	13	80	No return			9
10	Elgin	2·25	9	0	9	8	0	0	8	88	11	6	6	55	7	51	11½	5	4	71	9	0	0	10
11	Exeter	..	4	104	10½	7	2	0	7	85	29 3/10	3	17	48	7	0	28 3/10	3	12	26	No return			11
12	South Wales	2·08	6	98	8	6	17	46	3	19	4	6	6	88	5	40	8	5	17	6	8	0	0	12
13	North Wales	3·06	12	6	8¼	11	6	0	9	72	9¼	8	0	80	11	12	10½	8	6	66	10	0	94	13
14	Lancashire	2·33	1	70	4½	2	15	26	5	83	9½	4	18	77	4	86	5¼	7	7	68	7	3	64	14
15	Cumberland	3·11	5	60	11½	3	18	7	8	18	11½	5	8	0	5	41	10½	4	1	81	6	0	0	15
16	Ayr	2·62	14	18	10¾	10	10	109	15	21	15½	7	16	87	10	55	17	4	18	83	Lifted early			16
17	Munster	2·29	7	14	10½	5	12	15	6	28	9½	5	2	39	9	0	15½	4	15	5	No return			17
18	Connaught	..	8	70	12½	2	7	95	6	101	12½	4	9	71	4	43	14½	2	8	52	No return			18
19	Leinster	18·8	8	8	11	5	17	45	6	109	12	4	13	0	9	85	15½	5	2	43	No return			19
20	Ulster	3·75	10	21	11½	7	2	0	7	84	9 3/10	6	16	46	3	61	9	3	2	44	No return			20
	Total	..	161	55	..	143	16	26	160	92	..	123	10	54	153	111	..	116	10	38				
	Average per Acre of the twenty Estimates ..	..	..		..	7	3	90	..		..	6	3	58	..		..	5	16	57				

suffered more than the late varieties; but when the crop was raised it was found that there was 21 per cent. of the early, and 27 per cent. of the late, diseased. At Moynalty (Leinster) the potatoes were grown in lazy beds in a field which had been a neglected pasture for a great many years, and which was in very bad condition. On August 18th all the sorts were attacked by disease, the early again showing a greater injury that the late varieties. The disease first appeared in the potatoes growing under some large trees which bordered the field; at the time of my visit the foliage in these patches was quite blackened. When the crop was raised more than a fifth of the late varieties were diseased, and a smaller proportion of the early ones. The potatoes were in a very flourishing condition at Mullaghmore (Ulster), when I visited them on the 19th August, but the disease had made its appearance some days before, and already it was visible on the foliage of all the plots as well as of the general crop. In the prosecution of my inspection I found the disease present in the plots at Longtown and Perth, and more extensively at Ayr. At Elgin some of the general crop was injured by the disease, but as I have already stated I did not detect any trace of the disease at the stations in Northumberland and East Lothian.

The result of this visit to the various localities left no uncertainty as to the competition for the Society's prizes, but it was determined to carry out the programme fixed upon.

The condition of the crops as affected by the disease at the time they were raised is exhibited in the annexed (V.) and following (VI.) Tables:—

Table VI.—Showing the percentage of Diseased Tubers in the Eleven Localities where it was most severe, (1) in the Two Early, (2) in the Four Late, (3) in all Six Varieties.

Earlies.	Percentage.	Lates.	Percentage.	Both Varieties.	Percentage.
Ayr	60·5	Connaught ..	27·1	Connaught ..	25·3
Cumberland ..	24·2	Exeter	24·9	Ayr	23·6
South Wales ..	23·4	South Wales ..	22·4	South Wales ..	22·4
Connaught ..	21·7	Leinster	21·4	Exeter	20·9
Munster	18·6	Munster	10·3	Leinster	18·9
Ulster	18·0	Ayr	5·2	Munster	13·0
Perth..	15·2	Lancashire ..	4·4	Cumberland ..	10·9
Leinster	14·0	Cumberland ..	4·3	Ulster	7·4
North Wales ..	13·3	Perth	3·4	Perth	7·3
Exeter	13·0	Ulster	2·1	Lancashire ..	6·5
Lancashire ..	10·7	North Wales ..	0·0	North Wales ..	4·4

The only locality that entirely escaped the disease was Long Sutton, Lincolnshire. In the other localities not included in the above Table, traces of the disease were detected, varying somewhat in extent. Stafford had the largest proportion, and the others followed in this order:—Kent, Northumberland, Essex, East Lothian, Yorkshire and, lastly, Elgin.

In examining the information already given in the Tables and body of this Report with the view of discovering, if it be possible, an explanation of the greater prevalence of the disease in some districts than in others, it is important to notice the common starting-point in these experiments, and where the different conditions and agencies come into operation. The seed-tubers were in every case of the same stocks, and they were carefully selected, and believed by their respective owners to be characterised by a remarkable freedom, if not entire immunity, from disease. Each of the six bags received by every grower contained the same weight of the same kind of seed. The differences of condition and treatment began when the seed came into the possession of the growers.

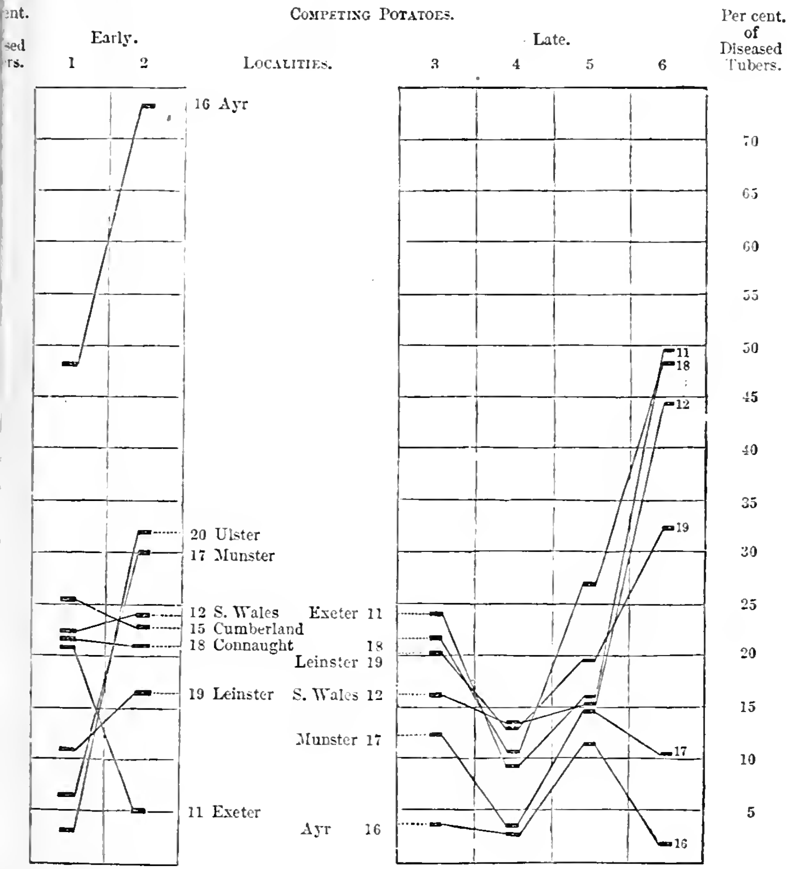
When the crops were raised the greatest differences as to the disease were found to exist in the various localities. At Lincoln the whole of the experimental crops were entirely free from disease, and comparatively little was seen in any of the plots on the eastern side of Great Britain, while at Ayr three-fourths of one of the early varieties were diseased, and at Connaught a half of one of the late varieties, and all along the western districts of the kingdom the crops were extensively destroyed. It seems obvious from these well-marked differences that the kind of the seed-tubers, which were the same in all the localities, cannot be the efficient cause of the disease. We may consequently set aside all the notions, still to a considerable extent prevailing, that the disease itself is due to anything peculiar to the variety, as, for instance, its supposed exhaustion from long cultivation of the tubers.

It should further be noted that the different varieties did not suffer from the disease to the same extent, but that under the same conditions there was, in the six kinds, great diversity in liability to disease. This fact is made apparent to the eye by the following diagram (p. 387).

It will be observed that in the same field and with the same treatment the second suffered much more than the first early potato, while among the late varieties the fourth suffered the least, the sixth the most, and the third and the fifth were almost equally affected. Still further this relation of liability to disease persisted, with an approach to uniformity, in the various localities, so that, as a rule, the fourth was the least affected by

the disease, and the sixth the most. The tendency of these results is to support the opinion that a potato may be found which will successfully resist the disease. In the crops at Exeter, South Wales, Connaught and Leinster, the fourth late potato suffered to the extent of only 11·6 per cent., while the sixth in the same four localities suffered no less than 43·8 per

GRAM showing the PERCENTAGE of DISEASED to HEALTHY TUBERS in the different OCALITIES in all the VARIETIES which in any locality had more than 10 per cent. Tubers diseased.



cent. The external conditions being the same to each of the kinds in each locality, it appears that the power to resist the attack of the fungus is due to some inherent property in the plant which is common to all the plants of the variety. Whatever this property is, there seems no reason to doubt that a

difference which has shown itself so obviously in these localities may be found in some varieties sufficiently pronounced to free them altogether from the attack of the disease.

I have made a microscopical examination of the leaf epidermis of the six kinds of potato with the view of ascertaining whether any character could be detected which might explain the freer access of the spores to one variety than to others. The upper surface of the leaf is sparsely covered with short curved hairs, which rise irregularly from the epidermal cells. These hairs are almost entirely confined on the under surface to the veins and their various and minute ramifications. The epidermis of the spaces between the veins gives off some scattered glandular hairs, composed of a small round transparent ball supported on a short jointed stalk. In none of the varieties are these hairs sufficiently numerous to prevent the spores lodging on the surface of the epidermis. The leaves of the two early potatoes are most densely covered with both kinds of hairs. I found no appreciable difference in the four late varieties.

In looking, then, at the conditions natural or applied under which the crops were grown, we may hope to find in them some help towards understanding the remarkable differences that are exhibited in the tables.

We may at once dismiss the soils from our consideration, seeing that the disease was severe as well on the peat of Connaught as on the loam of Ayr and South Wales, and the stiff clay of Exeter, while similar soils in other localities were free from the malady.

The information supplied by growers of potatoes led Mr. Jenkins, in his recent Report, to suggest the probability of the fungus which produces the disease being parasitic during part of its life on some other cultivated crop. As parasitic fungi, which, as far as the knowledge of them has been ascertained, might be related to the *Peronospora* of the potato, had been found on wheat* and clover,† and as the potatoes that escaped disease, in the returns on which his report was based, followed green crops, Mr. Jenkins recommended that observations should be instituted with the view of determining whether potatoes following wheat, and especially clover, were more liable to disease. Professor Farlow has, as we have seen, recommended the prosecution of similar inquiries in America. Last year's experimental crops do not give any support to the suggestion of Mr. Jenkins. In two localities, Staffordshire and Lancashire, the potatoes followed clover, and though in both places disease was found to have

* 'Journal of the Royal Agricultural Society,' second series, vol. viii. (1872), p. 213.

† Ibid., vol. x. (1874), p. 515.

ttacked all the kinds of potatoes, it was only to a small extent. n the majority of cases, as was to be expected, the potatoes ollowed crops of cereals; in the localities where the disease hiefly prevailed there were oats, but at Exeter the preceding rop was wheat. In one place, South Wales, they followed urnips, and here the potatoes suffered considerably from isease. As far, then, as these experimental plots throw any ight on the subject, it appears,—1, that the oospores of the ungus do not exist in the tuber, as has already been fairly emonstrated by the many careful investigators who have ailed to discover them in the tubers they have examined for his purpose; and, 2, that the oospores are not produced in the lants of previous crops. These side lights may help to the iscovery of the wanting link or links in the history of the ungus, but we must look to the labours of the cryptogamic otanist for satisfactory information, and it is matter of ongratulation that the Royal Agricultural Society have been so ortunate as to secure the co-operation of Professor De Bary in his work.

The presence of the disease is ascribed by many to the use of ertain manures. Artificial manures, guano, and farmyard-nanure are respectively condemned by different growers, each vithout any sufficient reason; while particular manures are put orward as specifics against the disease, as well as advantageous o the crop. If the hitherto undetected oospores of the fungi were ntroduced to the potato field with the manures, it is obvious hat artificial manures from the methods of their production nust be entirely free from these bodies. In three localities rtificial manures only were applied to the crops, but the results lo not hold out any hope that in this direction security may be btained. At Exeter 2 cwt. of nitrate of soda, and 3 cwt. of dis-olved bones were applied per acre, but a quarter of the late varie-ies were diseased. The early potatoes escaped with a smaller roportion, but this was due to the fact that they had ripened, nd the foliage of most of them had completely disappeared efore the disease showed itself in the last week of August. It s certain, moreover, that the full extent of the disease was not letected at Exeter when the crops were raised, as the day was howery, and the tenacious clay of the field in which they grew o adhered to the tubers that it was impossible, without washing very potato, to separate completely the diseased from the sound ubers. At Kent the only manure employed was half a ton to he acre of Odam's Potato Manure, and though the injury here vas slight all the varieties as well as the general crop suffered rom disease. At Bedfordshire seventy bushels of soot per cre were applied, and the crops were almost free from disease.

In the seventeen other localities the chief manure employed was farmyard-dung. This manure might be the medium of introducing the disease as the oospores of fungi are remarkably indestructible and might resist the destructive action of the dunghill, and even pass, without losing their vital powers, through the alimentary canal of animals. There is, however, no indication in last year's experiments that the appearance of the fungus had any connection with farmyard-manure. Lincoln, with ten tons per acre, was entirely free from disease, and Yorkshire with fifteen tons, and East Lothian with twenty-five tons, were but slightly affected, while similar quantities were employed in localities which suffered heavily.

The result of Dr. Voelcker's experiments at Carlisle,* showing that the kind of manure had no appreciable influence on the presence or extent of the disease, is confirmed by the experiments of last year.

If we divide the twenty localities into two groups, the one containing the places where the disease occurred to any appreciable extent, and the other, those that were more or less completely free from it, it will be observed that they arrange themselves geographically, the first group being all (excepting Perth) on the west side of the United Kingdom, while the second are on the eastern side. This grouping does not, of course, depend on temperature, soil, or method of cultivation, as there is nothing in common among the members of each group in regard to these points. But the two have each a somewhat close agreement in regard to the rainfall, the amount on the western side being much greater than on the eastern, consequently this division gives us for the eastern stations the smallest amount of disease and the least rainfall, and for those on the western side the largest amount of disease and the heaviest rainfall. We have already seen that as long as the season continued dry the potato crops were healthy, and that the disease immediately succeeded the heavy rains. There can be no doubt that the appearance and progress of the disease is intimately connected with the amount of moisture present in the atmosphere. Now that the fungus (*Peronospora infestans*, Mont.) has taken possession of our country, its spores abound in our air, and are ready to germinate whenever the proper conditions are present. As grain does not grow when stored in the barn, and deprived of moisture, so the spores of this fungus cannot germinate without a supply of moisture. They may rest on the surface of the leaves of the potato and remain perfectly harmless if the air contains no free moisture, for they can obtain none from the

* 'Journal of the Royal Agricultural Society,' vol. xxviii., p. 516.

nterior of the plant as long as they are external to it. In July or August, when the warm atmosphere drinks up to saturation he rain that has fallen, any slight reduction of the temperature, ike that caused by the setting of the sun, sets free a certain amount of water vapour ; the spores are able to appropriate what hey require of this vapour, and begin their active life by pushing out a small process or thread. Of all the spores which hus germinate only those that are in close relation to the host-plant are able to maintain their life. Stone and earth afford no nourishment to the young plant of the *Peronospora*, nor even he leaves and stems of any of the plants on the surface of which t may germinate, unless these belong to the potato. But vhen the small thread from the spore has pushed its way hrough a stomate or penetrated the skin, it obtains possession of a supply of food and moisture suited to all its needs, and speedily developes, destroying the plant in its progress, and hrowing into the air myriads of new spores to spread the nalady among the neighbours of its host.

The successful cultivation of the potato in relation to disease s then, judging from our previous knowledge and from the esults of last year's experiments, really the problem of combating the free atmospheric moisture, a battle whose issue is not uncertain. And as we cannot cope with this adversary, we shall, yielding to circumstances, probably see the cultivation of he potato travelling eastwards to the districts in our island vhere the rainfall is small, and the soil is naturally or artificially well-drained. Whenever the crops in the west can be secured before the July rains set in, there is no risk. At Ayr Mr. Wallace grows early potatoes extensively for the markets in he centre of England, and no crop could be more safe or profitable when thus managed. But the same field which yielded, early in the season, a heavy crop of perfectly healthy but immature tubers, produced in the autumn a crop of ripe potatoes n which, in one of the varieties, three-fourths were diseased, vhile the whole six varieties were injured on the average to he extent of very nearly one quarter.

The experiments of last year may supply information as to he best conditions under which the potato can be grown. Does he exact information contained in the schedules of the growers and the judges throw any light on the great differences in the actual yield of each hundredweight of seed, or in the estimated yield per acre? The results of the experiments in relation to he amount of crop produced is exhibited in the Table (VII.) nserted opposite page 385.

The most obvious fact on the face of this Table is that, with ew exceptions, the varieties selected by each grower for his

general crop yield a larger return than any of the competing potatoes. The early kinds cannot, of course, be fairly contrasted with late potatoes in respect of weight of crop. But it may be noticed that in each locality the produce of the early varieties and of No. 5 late were greatly below the general crop; that in four localities (Stafford, York, South Wales, and North Wales) the produce of No. 3 was heavier; in two localities (Kent and North Wales) the produce of No. 4 was heavier; and in one locality (Lancashire) the produce of No. 6 was heavier than that of the ordinary crops in these various localities. Returns respecting the general crops were received from only twelve out of the twenty localities. At Ayr the general crop was taken out of the ground long before maturity; and at Perth the general crop had been raised, without taking any notice of the produce per acre, before it was known to Colonel Ogilvie that this information was wanted. The gross yield of the competing potatoes and of the general crop in these twelve localities is shown in the following Table:—

TABLE VIII.—Showing the ESTIMATED PRODUCE of the EXPERIMENTAL POTATOES, and the ACTUAL PRODUCE of the GENERAL CROP per ACRE in the TWELVE LOCALITIES from which information has been obtained.

	Tons.	cwt.	lbs.
No. 1, Early	45	19	43
,, 2, Early	31	10	0
,, 3, Late	128	10	0
,, 4, Late	96	15	47
,, 5, Late	80	15	106
,, 6, Late	82	6	10
General Crop	126	10	16

If we except from this Table the extraordinary crop of No. 3, which Mr. Brawn raised at Sandhills, Staffordshire, which raises the total yield of that variety to a higher figure than the general crop, it becomes obvious that the farmers who assisted the Society are in possession of potatoes which yield, in their various localities, heavier crops than, with similar treatment, they have been able to obtain from any of the competing varieties.

The great differences exhibited in the Table in the actual produce of the one hundredweight of seed is very remarkable. In the first early, under the careful farming of Mr. Campbell, at Fermoy, there is a yield of only 88 lbs., or about three-quarters of the seed planted, while in Ulster Miss Rose obtained a crop weighing 10 cwt. 60 lbs. Again, at Morpeth a yield of 1 cwt. 54 lbs. was obtained from the seed of No. 4 late, while on the other side of the country, at Ayr, the same seed produced 14 cwt. 18 lbs. It is obvious from these and similar facts exhibited in the Table that all the varieties of potatoes are no

equally suitable to the different conditions of soil and cultivation met with in Britain. This is further confirmed by the fact already noticed that the competing potatoes in almost every case yielded a smaller produce than the varieties cultivated for the general crop in each locality.

In examining the conditions under which the best crops have been produced in the various localities, it is extremely difficult to discover any conditions that are common to several of them. There are in these experiments an amount of certain data which might be expected to supply materials for trustworthy deductions; but we discover, as is so often the case in agricultural experiments, many unaccountable anomalies. The agreements and differences should be most obvious when the localities producing the heaviest crops are contrasted with those producing the lightest. I have accordingly placed in Tables IX. and X. (page 394) the five localities with the heaviest, and the five with the lightest crops.

The five localities yielding the heaviest return of seed produced also the heaviest estimated crop per acre, with the exception of Bedford, where the size of the plot was unusually large. But though the plot was large, the average space for each sett was not more than 2·8 square feet, so that the division of the seed-tubers to form a large number of setts, while it produced a considerable return in weight for the weight of seed, yielded the comparatively small return of $4\frac{1}{4}$ tons per acre. The seed-potatoes were cut under Mr. Cocking's instructions into as many pieces as could be obtained, so that each piece should have two eyes. The weight of the crop at Bedford was considerably affected by the very dry summer, which stopped the growth of the tubers before they attained their full size. When the rain came the foliage of the early potatoes was dead; but that of the late varieties was still green and active, and in all of these a new formation of tubers began, either by the addition of a new portion to the apex of the already formed tuber, or more frequently by the throwing out from its buds or eyes of several new tubers. Half the weight of the crop at Bedford was due to these later-formed tubers. In several other localities in England the crops were similarly but not so extensively affected as at Bedford. The aerial portion of the early potatoes at Bedford being, as has been said, completely dead, the rains caused many of the tubers to sprout. It appears, then, from the results of the experiment at Bedford, that a large number of small setts do not produce so heavy a crop per acre as the same weight of seed planted in large setts. This is strikingly confirmed in Mr. Brawn's crop at Stafford, where, from cutting few of the seed-tubers, the hundredweight of seed occupied, on an average, only $5\frac{3}{4}$ poles. The yield of $51\frac{1}{2}$ cwt. for the 4 cwt. of seed is a large return;

TABLE IX.—Showing the FIVE HEAVIEST CROPS of the LATE VARIETIES (3, 4, 5 and 6), and the CONDITIONS under which they were GROWN.

	Yield of 4 cwt. of Seed.	SOIL.	DRAINAGE.	MANURE.	Seed, Whole or Cut.	Size of Plot.	Space for each Sett.	Estimate Weight per Acre.	Weight per Acre of Ordinary Crop.
	cwts. lbs.					poles.	feet.	tons. cwts. lbs.	tons. cwts. lbs.
Ayr	64 2	Loam on clay	3½ ft. deep, 24 ft. apart . .	30 tons farmyard, 4½ cwt. guano	All cut . . .	15	2·62	8 14 20	No return.
Stafford . . .	51 47	Sandy loam .	None	25 tons farmyard . . .	Partly whole, partly cut	5¾	2·06	18 1 88	21 5 0
Lincoln . . .	43 53	Loam on silt .	Thorn drains, 2½ ft. deep .	10 tons farmyard, 6 cwt. superphosphate .	Partly whole, partly cut	10	2·72	9 15 92	15 5 28
Bedford . . .	46 99	Loam on gravel	None	70 bushels of soot . . .	Partly whole, partly cut	21¼	2·81	4 5 81	9 7 100
North Wales .	46 52	Sandy loam .	1½ ft. deep . .	19 tons farmyard, 3 cwt. artificial	All cut . . .	9	3·06	9 15 27	10 0 94

TABLE X.—Showing the FIVE LIGHTEST CROPS of the LATE VARIETIES (3, 4, 5 and 6), and the CONDITIONS under which they were GROWN.

	Yield of 4 cwt. of Seed.	SOIL.	DRAINAGE.	MANURE.	Seed, Whole or Cut.	Size of Plot.	Space for each Sett.	Estimate Weight per Acre.	Weight per Acre of Ordinary Crop.
	cwt. lbs.					poles.	feet.	tons. cwts. lbs.	tons. cwts. lbs.
Lancashire . .	16 43	Peat on clay .	3 ft. deep, 24 ft. apart . .	16 tons farmyard, 4 cwt. artificial . . .	Partly whole, partly cut	6	2·33	5 8 25	6 0 0
Northumberland	19 59	Free soil on sandstone	3½ ft. deep. irregular . .	20 tons farmyard . . .	All cut . . .	12¾	2·62	3 10 9	No return.
South Wales .	23 78	Light loam on gravel	3½ ft. deep . .	20 tons farmyard, 6 cwt. artificial	5 whole, 3, 4, 6 cut	7½	2·08	6 16 91	8 0 0
Ulster . . .	23 4	Light . . .	None	22 tons farmyard, 5 cwt. artificial	Partly whole, partly cut	10½	3·75	5 9 19	No return.
Munster . . .	30 0	Loam on limestone	None	40 tons farmyard, 5 cwt. superphosphate .	All cut . . .	12	2·29	5 0 94	No return.

but 18 tons per acre, on an average of the four late varieties' and 27 tons for one of these varieties (No. 3), are remarkably heavy yields. On the other hand, at Ayr, the same quantity of seed, planted nearly three times the space, and while a heavier yield, weight for weight, was secured, the estimated produce, per acre, fell to $8\frac{3}{4}$ tons.

It appears then from these and other instances, which an examination of the Tables will show, that the potato which starts with a large supply of food in the tuber, and secures by its help a good hold on the soil and a good mass of foliage in the air, produces the most remunerative crop. The multiplication of the seed in these experimental crops by cutting the tubers, means, of course, nearly the same as occupying a large plot; for as the space allowed by the different growers for each sett was tolerably uniform, and as the number of seed-tubers was practically the same throughout, the necessity for a large plot was due to an artificially increased number of setts. The Tables in this view confirm the conclusion already stated, that a given weight of seed may be so spread out as greatly to reduce the yield, per acre, of the crop, even though the setts are not widely separated, but placed at a moderate and uniform distance from each other.

The average space allowed to each sett is from $2\frac{1}{2}$ to 3 square feet. This is somewhat more than the space which Mr. Maw determined to be the most profitable distance. His experiments showed that to give more than 2 square feet to each sett, gave no advantage in the shape of an increase of weight. It deserves the consideration of growers, in the face of his results, whether too large a space is not given to each sett, and the produce, per acre, accordingly reduced. Thus, to take the most extreme case in these experiments, had only 2 square feet been given to each sett in the Essex locality, the produce of No. 3 late might have been 16 instead of 7 tons.

The varieties of soil supply no sufficient explanation of the difference in amount of produce, although the richest soils exist in the localities which produced the heaviest crops.

It is still more remarkable that heavy manuring has not produced a corresponding result in the weight of crop. The experiments of Dr. Voelcker and the experience of growers point to the dung of the farmyard as the best potato-manure. Nevertheless, we notice that 40 tons of this manure, with 5 cwt. of superphosphate applied as a top-dressing, produced 5 tons per acre in Munster, while 25 tons, without any artificial manures, gave a crop of 18 tons per acre in Staffordshire. It is, however, certain that the most successful potato-growers use a large amount of manure.

Note.—By a printer's error in Table IV., Leinster and Ulster are numbered 18 and 19, instead of 19 and 20 as in the other tables.

XV.—*Note on Mr. W. G. Smith's Discovery of the Rest-Spores of the Potato-Fungus.* By W. Carruthers, F.R.S., Consulting Botanist to the Society.

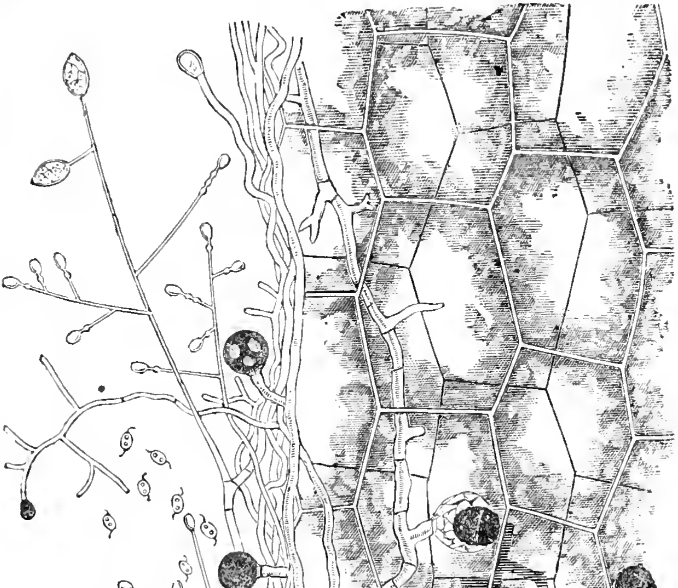
Since the preceding Report was in print the hiatus in the life-history of the potato-fungus has been filled up by the discoveries of Mr. W. G. Smith, F.L.S., which has been communicated to the Scientific Committee of the Royal Horticultural Society, and for which their author has received that Society's gold medal. The structure and life of the *Peronospora infestans*, Mont., as found on the foliage, haulm, and tubers of infested potatoes, were previously well known and had been frequently described; but the conditions under which the life of the parasite is continued from the autumn to the following summer have been the subject of frequent, persevering, but hitherto unsuccessful research. At the instigation of the Royal Agricultural Society, Professor De Bary has renewed his investigations in this direction, and has arrived at important though yet unpublished results. So obscure has this part of the life of the fungus been that some investigators have doubted whether the plant was a true *Peronospora* at all, and whether the desired information would not be discovered in some well-known fungus parasitic on a different group of plants from the potato, and whose connection with the fungus of the potato disease had not been suspected.

The importance of Mr. Smith's discovery is all the greater that the subject was surrounded with so much obscurity.

By the help of the engraving prepared for these pages by Mr. Smith himself, and of specimens that Mr. Smith has placed at my disposal, I am able to place before my readers the result of his addition to our knowledge.

It was in investigating the new aspect which the disease had assumed in some, especially in some American, varieties of potato that Mr. Smith discovered the rest-spores. With the view of separating the tissues for more exact examination, he placed in water some of the diseased leaves obtained from plants grown at Chiswick. He observed that the mycelium grew with greater rapidity in the water, and after ten days he found it producing a large number of minute spherical bodies of two kinds, the one considerably smaller than the other. He further observed specimens in which the already known fruits of *Peronospora infestans* were growing from the same mycelium as the newly-discovered bodies. One of these specimens is drawn in our illustration. There consequently remained with him no

doubt as to the relation of the spherical bodies produced by the mycelium in the substance of the leaves to the *Peronospora.*



Peronospora infestans, Mont. Showing the asexual reproduction by simple spores and by swarm-spores, with the free zoospores which have escaped from the cell of the swarm-spore; and also the sexual reproduction by antheridia and oogonia producing the rest-spore or oospore. Drawn from the stem of the Chiswick plants by Mr. W. G. Smith, F.L.S. Magnified 200 diameters.

These bodies exactly correspond with the sexual organs that De Bary had already described in several species of *Peronospora*

under the name of oogonia for the larger, and antheridia for the smaller bodies. Mr. Smith perceived that he had discovered the sexual organs in this species of *Peronospora*, and continuing his observations he traced the relation between the two bodies. He observed the small antheridia attaching themselves to the oogonia, and fertilising them, by discharging part of their contents into the larger cells through a small tube which was protruded into the substance of the oogonia. The growth of the fertilised oogonium, now called an oospore, was traced by him until it arrived at maturity, when it is a spherical body covered with warts or coarse reticulations and of a black-brown colour. It is but slightly larger than the cells of the leaf, being about one-thousandth of an inch in diameter.

When the rest-spores are mature, they separate themselves from the mycelium on which they grew, and lie as free bodies in the substance of the potato. And when in course of time the whole of the plant perishes, these small hardy bodies remain, able to endure through the winter, and ready to renew the life of the destructive fungus with the restored vegetable life of another year.

Mr. Smith has found the rest-spores in the haulm and tuber as well as in the leaf.

Having thus discovered the means by which the fungus maintains its life through the winter, we are able to look at the question of the possibility of doing something efficiently to mitigate if not destroy the evil. The malady which so extensively destroyed the silk-worms in the south of Europe some years ago, was unconsciously augmented by the producers throwing the dead worms together and keeping them within the establishment, thus increasing the conditions favourable to the growth of the fungus, and to the unlimited development of the spores. It was not until, by the advice of botanists, they cleared away from their silk-worm houses every dead insect and withered leaf, and cleaned the walls, that they got any mastery over the disease. So we have been unconsciously harbouring the potato disease in permitting the haulm and foliage to decay on the field or in dungheaps, which left the undecaying oospores behind ready to start into life when the proper conditions were present. Every care now should be taken to destroy by burning all diseased haulm; and as diseased tubers also harbour the rest-spores, these should be utilised in some way in which the spores could not be injurious, as by employing them in the manufacture of starch or British arrowroot. A vigorous and universal attempt thus to deal with the fungus might now greatly reduce the future liability to and extent of the disease, though it can never, I fear, deliver us entirely from it.

XVI.—*On the Chemical Composition of Phosphatic Minerals used for Agricultural Purposes.* By Dr. AUGUSTUS VOELCKER, F.R.S., Consulting Chemist to the Society.

IN 1861 I published a paper in this Journal on 'The Chemical Composition and Commercial Value of Phosphatic Materials used for Agricultural Purposes.' In that paper I gave an account of all the more important native phosphates which at the time were known in commerce, and utilised by manufacturers of artificial manures in the places of, or in addition to, cattle-bones, bone-ash from South America, and the refuse bone-charcoal or animal-black of sugar refiners.

The extraordinarily rapid development of the manufacture of artificial manures — a branch of industrial pursuit almost unknown thirty years ago,—and the large demand for phosphatic raw materials, have given a powerful impetus to the search for phosphatic minerals in all parts of the world, and led to the discovery of numerous deposits of more or less agricultural value, which have found their way into England since the publication of my paper in 1861.

In England, coprolite diggings are no longer confined to Cambridgeshire and Suffolk, but are found also in the adjoining counties of Norfolk, Bedfordshire, and Buckinghamshire.

In France extensive coprolite beds occur in great abundance, in the Ardennes and other districts; and phosphatic nodules and fossils useful for agricultural purposes have likewise been lately discovered in the south of France as well as in the north. It is chiefly from the neighbourhood of Boulogne, in the north of France, that French coprolites are sent over to England.

France further supplies English manure-manufacturers with phosphorite, large deposits of which were discovered some years past in the Department of the Loire and Garonne. This deposit is known in commerce as French, or Bordeaux phosphate. It resembles in many respects the phosphorite which is found in Nassau, in the valley of the Lahn, and which is commercially known as German, or Lahn phosphate.

Russia possesses extensive tracts of land in the Governmental department of Koursk, where coprolitic or phosphatic nodules occur in immense quantities. Russian coprolite beds are not as yet utilised to any extent; but there can be no doubt that they are of great importance to Russian agriculture, and doubtless will be explored at no very remote period.

Spain and Portugal, in the course of the year, send us a good many cargoes of phosphate.

From Norway we receive from time to time a comparatively small amount of apatite; and larger quantities of a crystallised or hard variety of apatite are sent to us from Canada, under the name of American or Canadian apatite.

Another phosphatic mineral largely imported into England at the present time is Charleston, or South Carolina, land and river phosphate.

From St. Domingo we obtain Alta Vela phosphate; and from the Redonda Island a crude phosphate of alumina which bears its name.

Other phosphatic minerals, sometimes called rock-guano, are found in more or less considerable quantities in the small coral-islands of Sombrero, Navassa, St. Martin's, Petro Keys, Aruba, and some other uninhabited small islands in the Caribbean Sea. All these, and some other phosphatic minerals, have been, and still are, constantly referred to me for examination. Probably nobody has had so many opportunities as I have of becoming acquainted with, or of obtaining a large experience in, all kinds of phosphatic minerals which are actually utilised in the manufacture of superphosphates, and similar artificial manures, which are produced in hundreds of thousands of tons annually in the numerous manure works all over England.

As a sequel to my paper published in the pages of this Journal in 1861, I propose to give a brief account of a number of phosphatic minerals which, at the time of the publication of my former paper, either had not been discovered, or were of interest only to scientific men.

Whilst treating of the composition of some of the more recently discovered phosphatic minerals, and their value for agricultural purposes, it may not be amiss for me to refer to some of the minerals, analyses of which were given in my former paper. A few selected analyses, made by me during the last and preceding years, it is hoped may be found useful in showing the chemical character of the present supplies of coprolites, of Sombrero, Spanish, and one or two other phosphates.

1. French Coprolites.

Most of the phosphatic nodules which are known in England under the name of French coprolites are dug up in the neighbourhood of Boulogne. They are generally sold as Boulogne coprolites, and are hardly distinguishable from some of those of inferior quality in Norfolk and Bedfordshire. Boulogne copro-

lites appear generally as dark grey or greenish-black coloured hard nodules ; some are small, and most of them are larger in size than Cambridge coprolites. The percentage of phosphate of lime in Boulogne coprolites seldom exceeds 46 per cent. ; it frequently falls below 45, and even to 40 per cent. and less, if the raised coprolites are not well washed and thoroughly dry before shipment.

During the last year or two I have made a large number of analyses of French coprolites, from which I select the following complete ones :—

DETAILED COMPOSITION OF BOULOGNE COPROLITES.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Moisture	·84	·79	1·08	1·18	1·74
Water of combination and loss on heating	3·14	3·24	3·08	1·91	1·04
*Phosphoric acid	21·06	21·27	21·27	20·70	17·69
Lime	33·06	35·38	33·58	30·41	31·12
†Carbonic acid	3·55	5·25	4·52	3·94	5·13
Sulphuric acid	6·81	·89	·90	3·24	·85
Fluorine, and loss in analysis		2·08	2·77		4·96
Magnesia	·58	·25	·69	·83	·56
Oxide of iron	2·89	3·63	3·54	6·24	3·52
Alumina	3·09	3·66	3·64	5·39	4·94
Insoluble siliceous matter ..	24·98	23·56	24·93	26·16	28·45
	100·00	100·00	100·00	100·00	100·00
*Equal to tribasic phosphate of lime	45·97	46·43	46·43	45·19	38·61
†Equal to carbonate of lime	8·07	11·93	10·27	8·95	11·66

It will be seen that Boulogne coprolites contain about one-fourth their weight of insoluble siliceous matter, and considerable proportions of oxide of iron and alumina. Like most coprolites, they also contain a good deal of fluorine. On the whole, they are poorer in phosphate of lime, and richer in oxide of iron and alumina, than Cambridge coprolites. They resemble closely in composition the inferior phosphatic nodules which at the present time are dug up in Bedfordshire and in Norfolk.

A superior variety of French coprolites is found in the valley of the Rhone, near Bellegarde, close to the Swiss frontier.

The following analyses, made in my laboratory, represent the chemical character of two samples of such coprolites :—

COMPOSITION OF TWO SAMPLES OF SUPERIOR FRENCH COPROLITES.

	No. 1.	No. 2.
Moisture and water of combination	2·79	2·95
*Phosphoric acid	25·10	27·76
Lime	40·11	41·88
Oxide of iron and alumina .. .. } Fluorine .. .. }	14·38	10·56
†Carbonic acid, &c.	..	7·10
Insoluble siliceous matter	17·62	9·75
	100·00	100·00
*Equal to tribasic phosphate of lime	54·79	60·60
†Equal to carbonate of lime	..	16·14

The sample No. 1 was taken from a bed at Bellegarde, in the south of France, consisting almost entirely of various phosphatic fossils, such as numerous varieties of terebratula, belemnites, ammonites, and sea-urchins, in a more or less perfectly entire state. Both samples were much lighter in colour than Cambridge coprolites; they were also softer, and more readily ground to powder. The second sample, it will be observed, contained about as much phosphate of lime as first-class samples of Cambridge coprolites, and not much more carbonate of lime.

Perhaps the most valuable coprolite deposits in France occur in the Ardennes; these deposits are as yet but partially developed. The cost of carriage is too great to render it probable that French coprolites, except those found close to the coast near Boulogne, will be largely exported into England. It is even doubtful whether the export of the latter will prove a paying speculation, for, as already stated, Boulogne coprolites as a rule seldom contain more than 45 per cent. of phosphate of lime, and they are too much impregnated with oxide of iron and alumina, two constituents which considerably lower the commercial value which they otherwise would possess. They fetch in the market a much lower price than good Cambridge, or Bedfordshire, or Norfolk coprolites; and under present conditions the importation of Boulogne coprolites into England, at the best, leaves but a scanty profit to dealers and exporters.

The composition of French coprolites varies to some extent, as will be seen by the subjoined Table showing the general composition of several cargoes, samples of which have been sent to me for analysis:—

GENERAL COMPOSITION OF FRENCH BOULOGNE COPROLITES.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
isture .. .. ıter of combination, &c.	3·86	·84 3·14	1·15 1·70	1·04 2·14	3·38	3·92	3·09
osphoric acid	19·82	21·06	21·15	18·63	20·51	20·48	22·57
ne	30·52	33·06	33·71	31·15	32·67	31·38	33·92
ide of iron, alumina, etc.	19·10	16·92	16·93	19·54	20·04	18·17	14·88
oluble siliceous matter	26·70	24·98	25·36	27·50	23·40	26·05	25·54
	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Equal to tribasic phosphate of lime	43·28	45·97	44·94	40·67	44·77	44·71	49·27

2. RUSSIAN COPROLITES.

Russia, I am informed, possesses an immense tract of land in the Governmental department of Koursk, where phosphatic nodules are found in large quantities. In appearance the samples of Russian coprolites which have come under my notice can hardly be distinguished from specimens of the coprolitic deposits in Bedfordshire. I have made only a single analysis of Russian coprolites, which yielded the following results:—

Composition of a Sample of Russian Coprolites.

Moisture and water of combination	3·55
*Phosphoric acid	22·42
Lime	33·84
Oxide of iron, alumina, fluorine, carbonic acid, &c.	9·94
Insoluble siliceous matter	30·25
	100·00
* Equal to tribasic phosphate of lime	48·94

This sample, it will be seen, contained in round numbers 49 per cent. of phosphate of lime, and about one-third its weight of insoluble siliceous matter. It had a dark-brown colour, and contained apparently a good deal of oxide of iron and fluoride of calcium, but not much carbonate of lime.

3. ENGLISH COPROLITES.

In the former paper, already quoted, I published several detailed analyses of Cambridge and Suffolk coprolites, to which the reader is referred.

Cambridgeshire still furnishes considerable supplies of the

best description of phosphatic nodules, as the following analyses of recent cargoes will show:—

GENERAL COMPOSITION OF CAMBRIDGE COPROLITES.

	No. 1.	No. 2.	No. 3.	No. 4.
Moisture	2·30	3·79	1·19	1·13
Water of combination, &c.	1·50		1·99	2·87
*Phosphoric acid	26·05	29·14	25·80	26·15
Lime	43·68	45·05	41·47	41·91
Oxide of iron and alumina	18·70	19·68	19·42	17·84
Insoluble siliceous matter	7·77	2·34	10·13	10·10
	100·00	100·00	100·00	100·00
*Equal to tribasic phosphate of lime ..	56·87	63·60	56·32	57·08

The sample No. 2 is unusually rich in phosphate of lime, the three other samples fairly represent the average composition of the present supply of good Cambridge coprolites.

Besides Cambridgeshire and Suffolk, the counties of Norfolk, Bedford, and Buckingham produce phosphatic nodules of various degrees of value to the manure-manufacturer. The following analysis represents the chemical character of a good sample of Bedfordshire coprolites:—

General Composition of Bedfordshire Coprolites.

Moisture and water of combination	3·35
*Phosphoric acid	23·47
Lime	36·29
Oxide of iron	5·39
Alumina, magnesia and fluorine	7·24
†Carbonic acid	3·45
Insoluble siliceous matter	20·81
	100·00
* Equal to tribasic phosphate of lime	51·24
† Equal to carbonate of lime	7·84

Most of the diggings in Bedfordshire furnish brown-coloured coprolites, containing a good deal of oxide of iron, and resembling in their chemical character Suffolk coprolites.

As a matter of curiosity, I quote an analysis of some beautiful specimens of fossil wood, which I found in a cargo of Bedfordshire coprolites:—

Composition of Fossil Phosphatic Wood found in Bedfordshire Coprolite Beds.

Moisture	1·12
Organic matter and water of combination	3·49
Lime	47·75
*Phosphoric acid	32·96
Oxide of iron and alumina, carbonic acid, &c.	10·49
Insoluble siliceous matter	4·19
	100·00
* Equal to tribasic phosphate of lime	71·95

The structure of the wood was most distinctly preserved. It will be seen that the fossilised wood had lost almost all its organic matter, and that it had been replaced mainly by phosphate of lime; the specimen analysed by me contained as much as 72 per cent. of phosphate of lime, and, comparatively speaking, little siliceous matter, and oxide of iron and alumina.

4. Welsh or Silurian Phosphate.

Phosphatic minerals were discovered some years ago in several places in North Wales. The phosphatic deposits occur not far from the lead-bearing clay-slate districts of Llangynag. The rocks are Silurian, of the Llandeilo series, and the phosphatic minerals occur in clay-slate. The slate contains merely traces of phosphoric acid, has a dark colour in some places, and, like most clay-slates, contains iron pyrites.

Mr. Hope Jones, of Hooton, Cheshire, has, I believe, the merit of having first directed attention to an extensive deposit of phosphatic minerals, which he discovered, whilst searching for other minerals, in the neighbourhood of a place called Cwmgynen, about twenty miles west of Oswestry. The strata (clay-slate) in this locality contain several beds of contemporaneous felspathic ash and scoriæ; and the usual fossils of the Llandeilo series are found, but not in great numbers. Mr. Hope Jones has traced the phosphatic beds a long distance, and has found them continuous for about two miles.

I have myself visited the phosphate mine at Cwmgynen, and also some other mines in the same locality where the Welsh phosphates are found.

The strata of the district are vertical, and the mine at Cwmgynen has a good natural drainage to a depth of about 500 feet. It can be economically worked in galleries for phosphatic limestone and black phosphatic shale. A true vein or fissure, containing mica and metallic deposits, separates the phosphatic

limestone from the black phosphatic shale. The vein and accompanying phosphatic deposits run east and west.

The black phosphatic slate or band is fully 18 inches thick, and the limestone-bed from 8 feet 6 inches to 9 feet. The vein which separates the two deposits from each other is 14 to 16 inches wide, and filled partially with white pipe-clay, calcareous spar, and copper and iron pyrites.

Since the discovery of the phosphate mine at Cwmgynen, others of a similar character have been found in North Wales; and to some extent Silurian phosphate has made its way into the hands of manufacturers of superphosphate of lime. The proportion of phosphoric acid in the black shale of Cwmgynen varies greatly. Towards the summit of the hill it is not nearly so rich in phosphoric acid as at a lower level, where it appears in compact masses, free from carbonate of lime, and containing but little iron pyrites, of which considerable proportions occur in the shale from a higher level.

A specimen taken from a compact block from the lower level of the mine, and weighing about 1 cwt., on analysis gave the following results:—

Composition of a Sample of Silurian Phosphate.

Organic matter and loss on heating (chiefly graphite)	3·98
*Phosphoric acid	29·67
Lime	37·16
Magnesia	·14
Oxide of iron	1·07
Alumina, fluorine, and loss in analysis	5·84
Insoluble siliceous matter	22·14
	100·00
* Equal to tribasic phosphate of lime	64·77

In this specimen of Silurian phosphatic shale no iron pyrites was visible to the naked eye, and as it contained but little iron, iron pyrites cannot have been present in appreciable quantities. It was also free from carbonate of lime; and besides black carbon, insoluble shale, alumina, and some fluoride of calcium, it contained the largest percentage of phosphate of lime which I ever found in picked samples from the Cwmgynen mine. In some places the black shale contains only from 25 to 30 per cent. of phosphate of lime. As already stated, it varies greatly in composition at different depths of the mine. The black shale, moreover, passes gradually into the phosphatic limestone-bed and in places contains from 10 to 15 per cent. of carbonate of lime and magnesia.

The following analyses of selected specimens of black shale from the mine at Cwmgynen in North Wales are illustrations of the variable character of this phosphatic mineral:—

COMPOSITION OF FOUR SAMPLES OF BLACK SILURIAN SHALE.

	No. 1.		No. 2.		No. 3.		No. 4.
Organic matter and loss on heating (chiefly black carbon or graphite) ..	6·16		4·87		6·25		3·67
*Phosphoric acid	25·35		24·78		23·31		26·88
Lime	33·58		35·98		28·19		35·36
Magnesia	·31		·13		5·22		·26
Oxide of iron	1·01		1·08		·58		1·89
Alumina, fluorine	1·06				1·21		5·38
Carbonic acid, and loss ..	..		..		12·01		..
Iron .. .. 3·51 } Iron pyrites	7·52	3·65	7·84	1·30	2·79	1·69	3·62
Sulphur .. 4·02 } Iron pyrites		4·19		1·49		1·93	
Sulphuric acid	·17		·21		·16		..
Insoluble siliceous matter	24·84		25·11		20·28		22·94
	100·00		100·00		100·00		100·00
* Equal to tribasic phosphate of lime	55·62		50·08		51·02		58·68

The specimens No. 1 and No. 2, it will be seen, contained over 7 per cent. of iron pyrites; No. 3, $2\frac{3}{4}$ per cent; and No. 4, about $3\frac{1}{2}$ per cent. Three of the specimens contained but little carbonate of lime, and merely traces of magnesia, whilst that marked No. 3 contained a good deal of carbonate of lime and magnesia.

I fear there are considerable difficulties in the way of working these North Wales mines in which Silurian phosphatic black shale occurs, so as to yield a phosphate of sufficient value to be a marketable commodity. In most places it is found to be practically impossible to separate effectually the richer from the worthless or quite inferior phosphatic shales and limestone; and in consequence the average specimens of the Welsh or Silurian phosphate mines often turn out very poor in phosphate of lime, and much impregnated with oxide of iron and alumina, carbonate of lime, and similar objectionable impurities, which lower the commercial value of the mineral. Silurian or Welsh phosphate, therefore, in many places cannot be worked with economical advantage.

Two cargo-samples of Welsh or Silurian phosphate analysed by me yielded the following results:—

COMPOSITION OF TWO CARGO-SAMPLES OF SILURIAN PHOSPHATE.

	No. 1.	No. 2.
Organic matter, and loss on heating	4·89	3·21
*Phosphoric acid	18·67	13·14
Lime	26·37	26·52
Oxides of iron and alumina, fluorine, carbonic acid, &c.	26·06	29·65
Insoluble siliceous matter	24·01	27·48
	100·00	100·00
* Equal to tribasic phosphate of lime	40·75	28·68

Mineral phosphates containing not more than the percentage of phosphate of lime which I found in these cargoes, and so large a proportion of oxide of iron and alumina, are hardly saleable in this country, and other samples which passed through my hands I found still poorer in quality.

Immense quantities of phosphatic shale unquestionably exist in North Wales; but the attempts to raise this mineral, I believe, have not hitherto been successful commercially, either to individuals, or to limited liability companies which have been formed for the purpose of exploring the mines.

5. CANADIAN PHOSPHATE.

Canadian phosphate is a variety of apatite which occurs in more or less distinct crystalline masses, or in crystals of a light green colour. It is found in large quantities in Canada, and occurs in fissures of granitic rocks, generally associated with gneiss or mica-slate. Usually it reaches this country in hard and heavy pieces, varying in size, and weighing from ¼ lb. to 3 lb. and upwards. Occasionally perfect crystals in the shape of six-sided prisms may be picked out from cargoes of Canadian apatite. These crystals have a light green colour, and glass-like lustre and brittle texture. In this pure state the mineral is a definite compound of phosphate of lime and fluoride of calcium. The commercial article, in addition to these constituents, contains a little oxide of iron, which imparts to it generally a light green and sometimes a reddish tint, and more or less of the rock in the fissures of which it is found. The shiny blades of mica, which generally are mixed up with Canadian apatite, give it a glistening appearance. Good cargoes of Canadian phosphate contain on an average from 70 to

72 per cent. of phosphate of lime, and cargoes are rarely shipped from Canada which contain less than 65 per cent. of phosphate of lime.

The following analyses will convey a good idea of the high quality which characterises most samples of Canadian phosphate :—

COMPOSITION OF CANADIAN PHOSPHATES.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
Moisture, water of combination, and loss on ignition	·62	·10	·11	1·09	·89	1·83
*Phosphoric acid	33·51	41·54	37·68	30·84	32·53	31·77
Lime	46·14	54·74	51·04	42·72	44·26	43·62
Oxide of iron, alumina, fluorine, &c.	7·83	3·03	6·88	13·32	12·15	9·28
Insoluble siliceous matter ..	11·90	·59	4·29	12·03	10·17	13·50
	100·00	100·00	100·00	100·00	100·00	100·00
* Equal to tribasic phosphate of lime	73.15	90.68	82.25	67.32	71·01	69·35

The sample No. 2, it will be seen, contained little more than ½ per cent. of insoluble siliceous matter, and was extremely rich in phosphate of lime. As a rule, Canadian phosphate contains no carbonate of lime, and but little oxide of iron and alumina ; but it always contains variable and generally considerable quantities of fluorine. On dissolving Canadian apatite in sulphuric acid, irritating fumes of hydrofluoric acid are given off in large quantities ; and as these fumes are poisonous, care should be taken to effect the treatment of the powdered mineral with acid in closed vessels provided with ventilating shafts for carrying off the obnoxious vapours.

Canadian phosphate is rather hard, and difficult to reduce to a fine powder, but it is otherwise well adapted for the manufacture of concentrated superphosphate.

The expense of freight from Canada to England in a great measure checks the development of the trade in Canadian phosphate, and in consequence not many cargoes find their way into England in the course of the year.

6. SPANISH AND PORTUGUESE PHOSPHORITE.

Extensive and valuable deposits of phosphorite are found near Logrosan, in the neighbourhood of the the towns of Caceres,

Montanchez, and other places in the province of Estremadura, in Spain.

Portugal also possesses extensive phosphate mines, and from both countries many thousand tons are annually shipped to England at the present time.

Dr. Daubeny, who visited the Logrosan deposits in company with Captain Widdrington, stated in his report, published in the 'Royal Agricultural Society's Journal' for 1845, that he found the deposits of the richest quality, and to be practically inexhaustible; but that the want of roads, and the expense of transport to Lisbon, the nearest shipping port, about 250 miles distant from the mines, rendered them valueless until better means of communication should open up the country.

Since the opening of the line of railway connecting Madrid with Lisbon, in 1867, numerous Spanish and Portuguese phosphate mines have been partially developed, mainly through the instrumentality of companies under the Limited Liability Act of 1862. After carrying on the mining operations for a few years, and sending the produce to England, most of the companies, for one reason or another, have been cut short in their existence.

The chief drawback in working Spanish phosphate mines successfully is the want of good roads, and the heavy expense which has to be incurred in carrying the produce of the mines on the backs of mules to the nearest railway station, and thence to Lisbon.

The means of communication in the districts where the phosphate mines occur have been greatly improved of late years; still there is ample room for further improvement in that respect, and in the mean time the Spanish phosphate mines are but little developed. There can be no doubt, however, that these mines will furnish at no very distant period a considerable proportion of the yearly supply of phosphatic minerals, for which there is a constantly and rapidly increasing demand. Phosphorite of Logrosan has a light yellow colour, and a fibrous crystalline structure, and is more or less interlaced with veins of quartz. It is hard and difficult to powder, and becomes phosphorescent on heating. The phosphate from the Caceres mines is softer, and of an almost perfectly white colour.

Generally speaking, Spanish and Portuguese phosphorites have either a white or only slightly yellow colour. The produce of different mines varies much as regards hardness and richness in phosphate of lime.

Phosphorite is frequently found in Spain in solid beds, varying in dimensions, and alternating with beds of limestone

and quartz. It always contains more or less, and not infrequently a good deal of, quartz, and as a rule either no carbonate of lime or only a small percentage.

Spanish and Portuguese phosphorites belong to the class of fluoride apatites. The proportion of fluoride of calcium, however, varies much in the produce from different mines, but all contain considerable proportions, occasionally amounting to 12 and even 14 per cent.

The following analyses show the composition, as ascertained by me, of very rich specimens of phosphorite from Caceres and Montanchez:—

Composition of Spanish Phosphorite.

	Caceres.		Montanchez.	
	No. 1.	No. 2.	No. 3.	No. 4.
Moisture	·21	·24	·16	·18
*Phosphoric acid	38·85	34·89	39·09	39·46
Lime	51·65	46·55	51·77	52·66
Fluorine, carbonic acid, and a little oxide of iron and alumina	2·61	2·91	3·02	4·95
Insoluble siliceous matter (quartz rock)	6·68	15·41	5·96	2·75
	100·00	100·00	100·00	100·00
* Equal to tribasic phosphate of lime ..	84·33	76·17	85·33	86·14

Practically speaking, these samples were free from oxide of iron and alumina, and they contained only an insignificant proportion of carbonate of lime, and all four were rich in phosphate of lime. The highest percentage of phosphate of lime which I ever found in a Spanish phosphorite was 88·98, that is in round numbers, 89 per cent.

Whole cargoes imported into England rarely, if ever, turn out so rich in phosphate of lime as the preceding samples. The finest cargoes seldom yield more than from 70 to 72 per cent., and the majority from 60 to 65 per cent. of phosphate of lime.

In illustration of the range of quality of recent shipments I quote the following analyses (p. 412) of samples representing whole cargoes imported into England since January of the current year. Some of these samples contained a good deal of carbonate of lime, a constituent which as a rule does not enter largely into the composition of Spanish phosphorite.

GENERAL COMPOSITION OF TWELVE CARGO-SAMPLES OF SPANISH PHOSPHORITE IMPORTED INTO ENGLAND IN 1875.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
Water	·58	1·10	4·99	·54	·34	1·14
*Phosphoric acid	34·47	33·26	32·30	31·07	30·53	29·45
Lime	45·73	48·20	47·20	42·42	45·79	42·65
Fluorine, and a little oxide of iron and alumina, carbonic acid, &c.	4·08	9·21	10·53	4·21	13·56	9·35
Insoluble siliceous matter ..	15·14	8·23	4·98	21·76	9·78	17·41
	100·00	100·00	100·00	100·00	100·00	100·00
* Equal to tribasic phosphate of lime	75·25	72·60	70·51	67·83	66·65	64.38

	No. 7.	No. 8.	No. 9.	No. 10.	No. 11.	No. 12.
Water	·84	·44	·55	2·24	·47	·99
*Phosphoric acid	27·94	27·87	26·61	26·55	25·74	18·71
Lime	40·99	36·50	37·85	38·13	34·06	33·14
Fluorine, oxide of iron, alumina, carbonic acid, &c.	10·03	2·73	10·24	10·18	2·52	18·02
Insoluble siliceous matter ..	20·20	32·46	24·75	22·90	37·21	29·14
	100·00	100·00	100·00	100·00	100·00	100·00
* Equal to tribasic phosphate of lime	60·99	60·84	58·09	57·96	56·19	40·84

In concluding this section, I add a complete analysis of a sample of Spanish phosphate which I made some time ago :—

Detailed Composition of a Sample of Spanish Phosphorite.

Water	3·59
*Phosphoric acid	33·38
Lime	47·16
Magnesia	traces.
†Carbonic acid	4·10
Sulphuric acid	·57
Oxide of iron	2·59
Alumina	·89
Fluorine and loss in analysis	4·01
Insoluble siliceous matter	3·71
	100·00
* Equal to tribasic phosphate of lime..	72·87
† Equal to carbonate of lime	9·31

The better qualities of Spanish or Portuguese phosphates

when ground fine and treated with sulphuric acid produce light coloured concentrated superphosphates. They find a ready sale in the English market, and fetch a better price per unit per cent. of phosphate of lime than coprolites and mineral phosphates containing much oxide of iron and alumina, inasmuch as superphosphates made from high grade Spanish phosphate retain their high percentage of soluble phosphate unaltered on keeping; whilst those made from materials containing much oxide of iron and alumina, on keeping become poorer in soluble phosphate, a portion of the soluble phosphate becoming precipitated, or reduced into insoluble phosphate by the presence of oxide of iron and alumina.

7. German or Nassau Phosphate.

In 1864, Mr. Victor Meyer of Limburg, subsequently proprietor of several extensive phosphate mines in the Duchy of Nassau, made the important discovery of a rich phosphate deposit in the neighbourhood of Staffel, a village near Limburg, in the Lahn Valley.

This discovery created a good deal of sensation at the time, and gave a powerful stimulus to enterprising men to search the length and breadth of the Lahn Valley and adjoining districts for phosphates. These explorations brought to light the existence of phosphate deposits in many other places in the Lahn Valley; and at the present time phosphate mines are worked in the neighbourhood of Wetzlar, Weilburg, Limburg, Dehren, Staffel, Medingen, Weilbach, and numerous other places.

The most extensive Lahn phosphate deposits are found on the left side of the River Lahn below Weilbach. The phosphate occurs in pockets, more particularly in places where limestone, dolomite, greenstone, and a siliceous rock, called, locally, Schalstein, are intermixed with each other. It is found in these pockets embedded in a ferruginous clay, and is obtained in lumps of various sizes differing greatly in appearance.

In some places the Nassau phosphate forms compact masses, having an earthy fracture, and light grey or yellow colour. In other localities it appears as a kind of conglomerate of broken pieces of phosphate cemented together by a red or brown-coloured clay, and intermixed with greenstone, manganese, and ironstone. More rarely it occurs in slates with a shaly fracture, and still more rarely in crystalline masses.

Frequently it has a cellular and porous structure, and occurs

in irregular masses, exhibiting a variety of colours, which give it a peculiar mottled appearance.

The richest varieties have a botryoidal structure, and are nearly white or light yellow; and equally rich are the deposits, which, like some of those found at Staffel, are covered with a light green crystalline semi-transparent incrustation.

Lahn phosphates of a low quality are more or less contaminated with clay-ironstone, clay, phosphate of iron and alumina, carbonate of lime, dolomite or manganese, and iron ores, or mixtures of all these impurities.

Unfortunately the richer qualities are becoming more and more scarce from year to year; and during the last two or three years the quality of German phosphate has deteriorated to a degree which has almost put a stop to the importation of Nassau phosphate into England.

After these general remarks on German, Nassau, or Lahn phosphate, as it is called indiscriminately in England, I wish to direct attention more especially to the chemical composition of a number of representative specimens and cargo-samples which have passed through my hands during the last ten years. In the first place, I subjoin detailed analyses of three selected specimens which I picked up at Staffel, on the occasion of a visit of inspection to the phosphate mines in the valley of the Lahn.

DETAILED COMPOSITION OF THREE SPECIMENS OF RICH NASSAU PHOSPHATE (STAFFELITE).

<table>
<tr><th></th><th>No. 1.</th><th>No. 2.</th><th>No. 3.</th></tr>
<tr><td>Water</td><td>·65</td><td>·25</td><td>·98</td></tr>
<tr><td>*Phosphoric acid</td><td>40·56</td><td>38·12</td><td>36·19</td></tr>
<tr><td>Lime</td><td>56·29</td><td>53·92</td><td>49·44</td></tr>
<tr><td>Oxide of iron</td><td rowspan="2">1·21</td><td rowspan="2">·93</td><td>·96</td></tr>
<tr><td>Alumina</td><td>3·07</td></tr>
<tr><td>Magnesia</td><td rowspan="2">·97</td><td>·69</td><td rowspan="2">2·88</td></tr>
<tr><td>Fluorine (by difference)</td><td>3·16</td></tr>
<tr><td>†Carbonic acid</td><td>..</td><td>2·75</td><td>1·87</td></tr>
<tr><td>Sulphuric acid</td><td>..</td><td>·09</td><td>..</td></tr>
<tr><td>Silica</td><td>·32</td><td>·09</td><td>4·61</td></tr>
<tr><td></td><td>100·00</td><td>100·00</td><td>100·00</td></tr>
<tr><td>* Equal to tribasic phosphate of lime</td><td>88·54</td><td>83·21</td><td>79·01</td></tr>
<tr><td>† Equal to carbonate of lime</td><td>..</td><td>6·25</td><td>4·25</td></tr>
</table>

The analyses of No. 1 and No. 2 were made with selected pieces of the light green crystalline semi-transparent incrus-

tations which occur here and there on Staffelite. No. 3 expresses the composition of a white botryoidal specimen from Staffel.

In the next place, I shall quote several complete analyses which I made of cargo-samples of rich Nassau phosphate.

DETAILED COMPOSITION OF THREE SAMPLES OF GERMAN PHOSPHATES.

	No. 1.	No. 2.	No. 3.
Moisture and water of combination	1·78	2·74	2·91
*Phosphoric acid	35·73	30·91	30·24
Lime	44·22	43·81	41·58
Magnesia	·42	..	..
Oxide of iron	7·38	6·66	8·86
†Carbonic acid	1·65	2·18	1·89
Alumina and fluorine	5·34	8·45	3·90
Insoluble siliceous matter	3·48	5·25	10·62
	100·00	10·000	100·00
* Equal to tribasic phosphate of lime	77·99	67·48	66·01
† Equal to carbonate of lime	3·75	4·95	4·22

It will be seen that these three samples contained a considerable amount of oxide of iron, and only a moderate percentage of carbonate of lime. Notwithstanding the high percentage of phosphate of lime in No. 1, this sample contained rather more than 7 per cent. of oxide of iron, and had a reddish-brown colour as deep as that of the two other samples.

There was nothing in the appearance of No. 1 indicating its superior character in comparison with No. 2 and No. 3 samples. On the contrary, any person judging it by its brown colour might have been excused for taking it to be low-quality phosphate.

Colour, then, cannot be relied upon in forming a correct estimate of the quality of Lahn phosphate. It is true the highest quality samples are generally white or light yellow, but at the same time I have met repeatedly with nearly white samples, which, on analysis, did not turn out to be particularly rich in phosphoric acid; and No. 1 is an example of a decidedly brown-coloured mineral phosphate, which was found to be unusually rich in phosphate of lime. Generally speaking, the appearance of most phosphatic minerals affords but little insight into their true character; and this remark holds good, specially in the case of German phosphates, which vary more than, perhaps, any other class of phosphatic minerals. Physical properties do not sufficiently distinguish high-class from low descriptions of Nassau phosphates, and chemical analysis alone reveals their real value.

In further illustration of the variable character of German phosphate, I quote the following analyses of cargo-samples:—

General Composition of Various Samples of Nassau, or Lahn Phosphates.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
Moisture and water of combination	2·32	2·40	2·42	2·54	1·39	3·86
*Phosphoric acid	33·49	32·05	31·08	30·52	26·67	26·02
Lime	45·52	44·44	42·53	42·20	38·27	37 62
Oxide of iron	3·97	13·94	15·77	16·16	3·41	5·06
Alumina, fluorine, carbonic acid, &c.	9·49				8·65	10·32
Insoluble siliceous matter ..	5·21	7·17	8·20	8·58	21·61	17·12
	100·00	100·00	100·00	100·00	100·00	100·00
* Equal to tribasic phosphate of lime	73·11	69·96	67·85	66·63	58·22	56·80

It may be stated that impure varieties are much more abundant in the Lahn valley than those richer in phosphoric acid. Although the quality may be considerably raised by the plan adopted in the German phosphate mines, of sifting and washing the impurer sorts, a large proportion of the mine-produce is too poor in phosphate of lime to repay the cost of exportation to England, for unless a cargo contains about 65 per cent. of phosphate of lime, German phosphate cannot be profitably sent into this country.

8. French Phosphate.

The discovery of mineral phosphates in the valley of the Lahn, in Nassau, has lately been eclipsed by that of extensive and valuable phosphatic deposits in the valley of the Lot, a tributary of the river Garonne, which flows through the upper and middle beds of the Jura and the lias formations. During the last few years large quantities of phosphate have been imported into England from the South of France. This phosphate is known in England under the name of French, or Bordeaux phosphate, it being usually shipped from that port. Like Lahn phosphate, the French deposit occurs in pockets, and varies greatly in appearance, texture, and in its chemical composition and commercial value.

Occasionally French phosphate is found in snow-white compact masses of a moderate degree of hardness, and breaking

with an earthy fracture. More frequently it has an opal-like appearance, a greyish colour, a waxy lustre, and conchoidal fracture. The white and opal-like specimens I find are very rich in phosphoric acid, as are also those which occur in botryoidal masses, or stalactitic forms.

The more ordinary kinds have a yellow or brown colour; they are dense and hard to grind, but readily decomposed by sulphuric acid, and well adapted for the manufacture of high grade superphosphates.

Inferior samples usually have a dark brown colour, or they appear as mottled and irregular masses or breccias, closely resembling some descriptions of Lahn phosphate, from which they are hardly distinguishable in appearance, or by their chemical composition.

When French phosphate was first brought into the English market, it frequently contained over 74 per cent. of phosphate of lime, and rarely less than 71 per cent. It would appear that at first only the richer deposits were worked in France and sent over to England, probably with a view of securing a good reception to the newly discovered deposits.

The percentage of phosphate of lime in high quality samples examined by me during the last two years has been somewhat lower than formerly; and cargoes containing on an average not more than from 58 to 65 per cent. are now not unfrequently shipped at Bordeaux for the English market. It thus appears that either the best quality of French phosphate is already becoming somewhat scarce, or that the increasing demand for phosphatic materials necessitates the exploration of the more abundant deposits of an inferior quality.

I have not seen anywhere a full analysis of Bordeaux phosphate; I therefore subjoin the results (p. 418), which I obtained in carefully analysing two cargo-samples which I received in 1872.

The sample No. 1, it will be seen, contained $77\frac{1}{2}$ per cent. of phosphate of lime, a little oxide of iron and alumina, and about 4 per cent. more carbonate of lime than the second sample, which also contained but little oxide of iron, but a good deal of alumina.

In the next place I put on record a few analyses of high, medium, and low quality samples, all taken from cargoes imported into England during the current year.

All these samples rank with the highest class of mineral phosphates; some apparently contain rather more carbonate of lime than others, but all contain but little iron and alumina. They all had a light yellowish-grey colour.

Detailed Composition of Two Samples of Rich Bordeaux Phosphate.

	No. 1.	No. 2.
Moisture	2·28	3·28
Water of combination	2·52	1·24
*Phosphoric acid	35·51	33·72·
Lime	47·81	44·23
Magnesia	·12	1·74
Fluorine (by difference)	·89	
†Carbonic acid	5·06	3·26
Sulphuric acid	·64	..
Oxide of iron	2·80	2·66
Alumina		6·42
Insoluble siliceous matter	2·37	3·45
	100·00	100·00
* Equal to tribasic phosphate of lime	77·52	73·61
† Equal to carbonate of lime	11·50	7·40

General Composition of High Quality French Phosphates.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7
Moisture	2·60	2·90	3·01	3·07	3·43	3·50	4·2
Water of combination	2·62	1·01	2·11	·50			
*Phosphoric acid	34·46	34·91	34·01	35·30	34·91	34·71	33·3
Lime	46·11	48·16	46·77	46·14	47·79	46·73	48·1
Oxide of iron and alumina, carbonic acid, &c.	10·77	9·44	11·61	12·40	12·07	11·01	10·6
Insoluble siliceous matter	3·44	3·58	2·49	2·59	1·80	4·05	3·6
	100·00	100·00	100·00	100·00	100·00	100·00	100·0
* Equal to tribasic phosphate of lime	75·23	76·21	74·24	77·06	76·21	75·77	73·7

Composition of French Phosphate of Medium Quality.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
Moisture	·89	7·22	1·64	6·02	9·76	6·70
Water of combination	2·58		1·64	3·34		
*Phosphoric acid	31·50	31·68	30·47	30·74	30·07	29·02
Lime	41·12	36·20	44·69	41·65	31·58	37·12
Oxide of iron and alumina, carbonic acid, &c.	13·73	19·19	17·43	13·71	22·15	15·08
Insoluble siliceous matter	10·18	5·71	4·13	4·54	6·44	12·08
	100·00	100·00	100·00	100·00	100·00	100·00
* Containing tribasic phosphate of lime	68·76	69·16	66·52	67·10	65·64	63·35

A glance at the preceding analyses will show that the relative proportions of lime, and of oxide of iron and alumina, in the several samples vary to a much greater extent than the percentages of phosphoric acid; from which it appears that some of the samples, for instance No. 2 and No. 5, contained a good deal of oxide of iron and alumina, partly combined with phosphoric acid.

Composition of French Phosphate of Inferior Quality.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
Moisture	·99	5·64	6·81	5·64	5·62	6·92
Water of combination ..	6·48					
*Phosphoric acid	26·66	26·45	25·96	26·45	25·02	24·46
Lime	32·92	38·39	31·51	38·39	36·98	34·65
Oxide of iron and alumina, carbonic acid, &c.	23·42	19·83	21·63	19·83	19·90	23·86
Insoluble siliceous matter ..	9·53	9·69	14·09	9·69	12·48	10·11
	100·00	100·00	100·00	100·00	100·00	100·00
* Equal to tribasic phosphate of lime	58·20	57·74	56·67	57·74	54·62	53·40

Most of these and other inferior samples of French phosphate which I have analysed this year contained a large proportion of phosphate of iron and alumina, as well as hydrated oxide of iron and alumina; and in this respect they intimately resembled inferior and impure Lahn phosphates.

Both the German and French phosphates of low quality, showing from 50 to 54 per cent. of phosphate of lime, contain more oxide of iron and alumina than samples of English coprolites equally rich in phosphoric acid, and are not worth a much money as the latter.

9. South Carolina, or Charleston Phosphates.

Phosphatic nodules, similar in many respects to the coprolites of the London Basin, have of late years been discovered in great abundance in the calcareous strata of the Charleston Basin.

Although the material which at the present time is largely imported into England under the name of South Carolina, or Charleston phosphate, was known perfectly well in 1843, and probably as early as 1795, its value remained undetected; and until within the last seven years it was regarded as worthless for all practical purposes; nor was its true chemical character known previous to that period. The first shipments that can be traced,

as made with a view to bring its value and utility before the public, it appears was made on the 4th December, 1867, by Messrs. W. D. Dukes and Co., to Mr. Geo. E. White, New York; on the 15th December, to Dr. Clements, of Baltimore; and on the 19th December the Charleston Mining and Manufacturing Company shipped, per steamer 'Falcon,' to Geo. P. Lewis, of Philadelphia, sixteen tierces.

Professor Tuomey, in his 'Geology of South Carolina,' p. 153, says:—

"The calcareous strata of the Charleston Basin occupy an irregular area of 55 to 60 miles, extending from the Santee on the east, to the Ashepoo River on the west, and lying between the Atlantic Ocean on the south and east, and the limits of the Buhrstone formation on the north.

"Of these the Santee beds are geologically the lowest and oldest, and consist of thick beds of white limestone, marl, and green sand. They dip or slope gently towards the south, and underlie the newer Eocene marls of the Cooper and Ashley rivers, of which those of the Ashley are most recent, and constitute the top of the Eocene series.

"The combined thickness of these with those of the Santee beds is reckoned at 600 or 700 feet. The beds underlie the city of Charleston, as proved by borings taken in 1824 from the Artesian well; and extend under the harbour, as shown by specimens of marl brought up by the anchors of vessels; and also by borings from the well at Fort Sumter, which, at 300 feet, brought up the green sand of the Santee beds."

On page 235 he states:—

"The other marls and marlstones of the State present every variety, from a pulverulent mass to the solid rock. . . . They are rich in calcareous matter beyond example; and in addition to this, they contain phosphate of lime in very valuable proportion. This exceedingly interesting ingredient is found most abundantly on the marls of the fish bed of the Ashley, where it is derived from the bones of marine and land animals buried in that deposit. The remains of crustaceous animals found in nearly all the beds indicate another source of this substance."

In or about the year 1844, Professor Holmes published the results of his experiments on "Marling" in the columns of the 'South Carolina Agriculturist;' and in describing the superposition of the beds in his marl-pit, mentions a remarkable bed of nodules as "conglomerates," 12 inches thick, bedded in the clay and sand, which overlaid the heavy beds of marl below. Whilst searching for phosphatic materials, Dr. Pratt found in 1867 that a bed or stratum, outcropping within ten miles of

the city of Charleston, contained phosphatic nodules in great abundance.

This bed or stratum, Dr. Pratt says, has been long known in the history of the geology of South Carolina as the Fish Bed of the Charleston Basin. It is found outcropping on the banks of the Ashley, Cooper, Stono, Edisto, Coosaw, and Combahee rivers, or their tributaries; but it is developed most heavily and richly on the Ashley, and no doubt extends along the coast east, and especially west, to unknown limits, and has been found as far inland as forty or fifty miles.

According to the same authority, the bed varies from 17 to 18 inches in thickness, sometimes, though rarely, increasing to two or three feet, and in some places it thins out to a few scattering nodules on or near the surface. It consists essentially of indurated, irregular-rounded nodules, buried in an adhesive and tenacious blue clay and sand; sometimes, however, it exists in continuous beds, or large lumps, or conglomerates of soft chalky consistency, as if it had been originally a soft pasty mass of phosphatic mud, that has since become semi-consolidated. Associated with these are a most wonderful assortment of animal remains, among which bones of marine animals are so abundant as to have induced Professor L. Agassiz, twenty years ago, to call it "the Fish Bed of the Charleston Basin."

But the chief supply of phosphate of lime is not to be found in the fossil bones, but rather in the nodules, which appear to constitute in some places from one-third to one-half of the entire weight of the stratum.

The area of the bed containing phosphatic nodules in workable quantity is stated by Dr. Pratt to be not less than 40 or 50 square miles. The phosphatic nodules lie along the water-courses of the country, over the area mentioned above; on the banks of the rivers and smaller steams, and of the swamps now or formerly discharging their waters into these streams; and are not found in any abundance or available quantity beyond 400 or 500 yards from the water-courses and swamps. They are generally found in the detached deposits at very irregular intervals along the banks. The means requisite for making even a rough approximation to the area they actually occupy are not easily attained, and probably they occupy less ground than has been stated.

The phosphatic nodules are generally rough, and irregular in form, water-worn and rounded, and of light yellow or brownish colour; they are tolerably soft, cavernous, often perforated by boring shells, and show casts of fossils. Fish teeth and fragments of bones are also frequently associated with them.

There are two kinds of Charleston phosphate, the land and the

river deposit. The land phosphate deposit is lighter coloured and softer than the river phosphate. It is altogether dug by hand with spade, pick, and shovel, a portion being taken from the sand that overlies it; but the main yield is from the clay in which it is imbedded, and which is the best land rock. But the clay, we are told, is hard to separate, requiring much care and time to remove it by washing; while that found in the sand readily yields to the action of water, and is less expensive to clean. The land phosphate is private property, and mostly owned by the parties who work it; or it is rented by them, or worked in shares, or for a subsidy, and they pay no tax or royalty to the State for removing the rock.

The first importations of Charleston or South Carolina land phosphate were not washed properly, and generally contained a larger percentage of sand than more recent cargoes brought to England.

The following analyses of two samples of Charleston land phosphate made in my laboratory show its composition in detail.

Detailed Composition of Two Samples of South Carolina Land Phosphate.

	No. 1.	No. 2.
Moisture	2·78	5·38
Water of combination		1·79
*Phosphoric acid	24·15	24·66
Lime	35·78	37·18
Magnesia	·57	·76
Oxide of iron	3·99	4·15
Alumina	3·20	4·90
†Carbonic acid	2·91	4·08
Sulphuric acid	1·84	not determined.
Alkaline chlorides (common salt)	2·15	..
Fluorine and loss	3·50	2·05
Insoluble siliceous matter (fine sand)	19·13	15·05
	100·00	100·00
* Equal to tribasic phosphate of lime	52·72	53·83
† Equal to carbonate of lime	6·61	9·27

Charleston land phosphate is readily ground to a fine powder. It contains less carbonate of lime than good Cambridge coprolites, but rather more oxide of iron and alumina, and siliceous matter. The proportion of phosphate of lime in Charleston land phosphate seldom exceeds 55 per cent., and frequently it is less. When treated with sulphuric acid it makes a good superphosphate, and on the whole is preferable to, and rather

more valuable than, Suffolk or Bedfordshire coprolites of an equal percentage of phosphate of lime, but more largely contaminated with oxide of iron and alumina.

For commercial purposes full analyses are not required, and from a large number of such analyses I select a few in illustration of the extent of variation which actually occurs in this description of phosphate.

Composition of Williman's Island Phosphate (South Carolina Phosphate).

	No. 1.	No. 2.
Moisture and water of combination	4·32	3·13
*Phosphoric acid	24·63	24·85
Lime	37·43	37·01
Oxide of iron and alumina, carbonic acid, &c. ..	15·33	17·76
Insoluble siliceous matter	18·29	17·25
	100·00	100·00
* Equal to tribasic phosphate of lime	53·77	54·25

Composition of South Carolina Land Phosphates.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
isture .. .. ter of combination	7·40	2·29	10·30	3·98	8·01	6·59 1·09	7·69 1 34
osphoric acid	26·50	24·29	22·06	25·47	23·93	24·80	23·35
ne	37·20	38·71	37·24	40·11	36·75	38·84	36·41
ide of iron and alumina, agnesia, carbonic acid, &c.	16·27	17·28	15·45	18·82	16·88	17·01	16·54
oluble siliceous matter ..	12·63	17·43	14·95	11·62	14·43	11·67	14·67
	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Equal to tribasic phosphate of lime	57·85	53·02	48·16	55·60	52·24	54·14	50·98

It will be seen that the composition of Charleston land phosphate varies to some extent; the deficiency of phosphate of lime in some samples is principally due either to an excess of water in the cargo, or to the phosphate not having been washed with sufficient care, whereby it has not been deprived as much as possible from adhering sand.

The Charleston river phosphate has a dark grey, almost black colour, and is much harder than the land phosphate. It generally contains a little iron pyrites, and when well washed and dried is fully equal to the best Cambridge coprolites for the manufacture of superphosphate, as the following analyses will show:—

COMPOSITION OF CAROLINA RIVER PHOSPHATES.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No.
Moisture .. .. / Water of combination and loss on ignition	4·07	1·56	2·57	2·64	1·86	2·89	2·
*Phosphoric acid	28·44	26·89	27·11	26·97	26·89	27·44	25·
Lime	45·07	42·28	42·79	42·54	42·43	42·45	39·
Magnesia, carbonic acid, oxide of iron, alumina, &c.	15·16	18·47	17·54	17·57	17·39	17·80	16·
Insoluble siliceous matter ..	7·26	10·80	9·99	10·28	11·43	9·42	16·
	100·00	100·00	100·00	100·00	100·00	100·00	100·
* Equal to tribasic phosphate of lime	62·09	58·70	59·18	58·87	58·70	59·90	55·

Most of the cargoes of Charleston river phosphate which have arrived in England during the last two years, I have found richer in phosphate of lime, and more valuable, than the great majority of the shipments of land phosphate, samples of which have, during that period, been sent to me for analysis.

"The river deposit being mined from the navigable rivers, the property of the State can only be mined by consent of the Legislature, which has granted charters to two companies, requiring them to pay to the State one dollar per ton royalty for every ton mined and removed. This deposit is worked by hand from April to September, but the business proper is done by machinery, which is worked at all times of the year. And as the rock is raised through the water, either out of the mud or sand, it is easily separated by the washers that accompany the dredges. This deposit furnishes the bulk of the supply now received."

The preceding paragraph is taken from an official report compiled and published by the Charleston Chamber of Commerce on the Trade and Commerce of the city of Charleston, S. C., from September 1, 1865, to September 1, 1872.

The same Report gives some interesting statistics respecting the production and shipment of Charleston phosphates. Amongst other particulars it supplies the following Tables:—

I. A Statement, in Tons, of the Quantity of Crude Phosphate Rock shipped to Foreign and Domestic Ports up to July 1, 1872.

Date.	Shipments.	To Foreign Ports.	To Domestic Ports.	Total.	Grand Total Value.
		Tons.	Tons.	Tons.	
1867	From Charleston and Beaufort	..	6	6	
1868	Ditto	208	11,654	11,862	
1869	Ditto	3,760	24,511	28,271	
1870	Ditto	13,652	40,099	53,751	
1871	Ditto	42,923	21,869	64,792	
1872	Ditto to 1 July	29,682	17,941	47,623	
Totals		90,225	116,080	206,305	$1,450,000,000
Consumed by Local Companies			..	36,110	$250,000,000
Grand Total			116,080	242,415	$1,700,000,000

II. A Statement, in Tons, of the Quantity of Crude Phosphate shipped in each Year, from January 1, 1867, to July 1, 1872.

Name of Shipper.	1867.	1868.	1869.	1870.	1871.	1872 to July 1.
Wando Mining and Manufacturing Co.	Sample	2,279	241	562	..	..
Charleston Mining and Manufacturing Co.	6	4,383	10,865	15,590	11,881	17,728
A. J. and O. A. Moses ..	..	581	2,484	5,023	..	..
Hard Farm, C. H. and Co.	..	..	1,612	3,438	350	500
Coosaw Company	..	..	..	..	1,829	4,331
Marine and River Mining and Manufacturing Co.	..	..	..	3,262	19,337	11,390
G. S. Cameron	..	..	273	4,179	239	..
Oak Point Mines	..	..	180	2,300	9,450	4,030
Williman's Island Co.	..	..	..	800	3,615	1,200
Pacific Guano Company	..	500	800	2,300	4,200	3,500
Chicora Company	..	..	..	..	1,030	752
Palmetto Company ..	..	..	..	..	1,976	444
Carolina Fertiliser Co.	..	..	1,260	5,999	4,197	1,250
W. L. Dawson	..	862	2,287	2,359	2,795	..
F. H. Trenholm	..	3,000	3,000	..	..	..
Ashley Mining Company, Williams Middleton ..	..	250	2,000	2,250	1,500	..
C. C. Pinckney	..	..	200	270	520	610
Sundry shippers	..	7	3,069	5,419	1,873	1,888
Total tons	6	11,862	28,271	53,751	64,792	47,623
Consumed by Local Companies	..	400	3,687	11,490	9,396	11,137
Totals	6	12,262	31,958	65,241	74,188	58,760
Total tons	..	..	..	..	..	242,415

10. Sombrero Phosphate.

Sombrero rock-phosphate is found on the small uninhabited island of Sombrero, one of the group of the Leeward Islands in the Caribbean Sea, situated about 60 miles east of the Danish West Indian Islands, and the same distance from Guadeloupe.

This valuable rock-phosphate was noticed in my paper published in 1861, in which a number of detailed analyses of it will be found.

At one time large quantities were imported into England; but at the present time not many cargoes are sent to this country, and it is to be feared that the greater portion of the accessible rock has been quarried and carried off.

In 1865 a Company was formed for the purpose of working and exporting this phosphatic rock; but, mainly on account of insufficient capital, it failed in 1870. However, the liquidator of the Company managed the business of the creditors so favourably, that in 1871 a new Sombrero Company was constituted, with whom rests, at present, the exploration of the phosphate still existing on the island.

At present the rock is worked under the level of the sea at much expense, and the exportation is effected under considerable disadvantages, for the island is surrounded by coral-reefs, and ships are therefore obliged to cast anchor at some distance from the island, and to take in their cargo from lighters; and during the stormy season, extending from September to January, the shipping has to be suspended altogether.

The following is the composition of four cargoes imported into England in the course of the current year:—

Composition of Sombrero Phosphate.

	No. 1.	No. 2.	No. 3.	No. 4.
Moisture	..	7·03	7·63	8·92
Water of combination	8·14	1·64	1·49	
*Phosphoric acid	32·82	32·45	31·70	31·73
Lime	45·33	46·11	45·92	45·69
†Carbonic acid	5·58	7 33	7·30	5·99
Oxide of iron and alumina, &c.	7·14	4·29	4·87	7·07
Insoluble siliceous matter	·99	1·15	1·09	·60
	100·00	100·00	100·00	100·00
* Equal to tribasic phosphate of lime ..	71·65	70·84	69·20	69·27
† Equal to carbonate of lime	12·68	16·64	16·59	13·61

The Sombrero phosphate of recent importations is a light-coloured and tolerably porous material, which is readily ground

to a fine powder. It contains but little oxide of iron and alumina, but rather more carbonate of lime than in former years, which appears to indicate that at present the phosphate is mined in close proximity with the coral rock on which it rests.

11. Navassa Phosphate.

The small uninhabited island of Navassa is another island in the Caribbean Sea which supplies a phosphatic rock. It is situated in 18° 25′ north latitude, and 75° 5′ longitude west of Greenwich; 33 miles south-west of Hayti, and 72 miles east of Jamaica.

It appears to be a coral island raised from the sea; and, like the island of Sombrero, it is surrounded by coral reefs, which greatly impede the shipment of the rock.

The coral rock which forms the framework of the island is full of cavities, and these are filled with phosphatic mineral deposits of a reddish-brown colour.

The bulk of the deposit consists of globular grains of phosphate of lime, cemented together into hard masses and contaminated with a good deal of oxide of iron and alumina, some carbonate of lime, and siliceous matter.

Navassa phosphate, like most minerals of a similar character, varies in composition, as will be seen by the following detailed analyses of three samples, made in my laboratory:—

Detailed Composition of Navassa Phosphate.

	No. 1.	No. 2.	No. 3.
Moisture	5·91	8·50	12·08
Water of combination and organic matter	5·46	4·15	
*Phosphoric acid	31·18	28·47	31·15
Lime	37·70	34·07	38·58
Magnesia	..	·45	..
†Carbonic acid	2·38	2·30	2·29
Oxide of iron	4·18	4·49	3·98
Alumina	9·11	9·48	9·30
Sulphuric acid, fluorine, &c.	1·16	1·81	
Insoluble siliceous matter	2·92	6·28	2·62
	100·00	100·00	100·00
* Equal to tribasic phosphate of lime ..	68·07	62·15	68·01
† Equal to carbonate of lime	5·41	5·22	5·20

The total amount of lime in Navassa phosphate is insufficient to form, with the carbonic and phosphoric acid, carbonate and tribasic phosphate of lime, and consequently a portion of the phosphoric acid must be united either with oxide of iron or with

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alumina, or probably both. Navassa phosphate, it will be seen, contains rather much oxide of iron and still more alumina, two constituents which lower the commercial value which it would otherwise possess, inasmuch as superphosphate, made from this material, becomes poorer in soluble phosphate of lime, after it has been kept some time, than it was when first made. This remark applies to all raw phosphatic minerals containing much oxide of iron or alumina. The acid employed in dissolving such crude phosphatic minerals at first attacks mainly the phosphate of lime, and changes it into soluble phosphate and sulphate of lime; but, on keeping, the acid soluble phosphate reacts upon oxide of iron and alumina, and to some extent parts with its acid, which, combining with the latter to form insoluble phosphate of iron and alumina, causes the precipitation of a corresponding quantity of insoluble phosphate of lime, or in other words, iron and alumina lead to the reduction of soluble phosphate of lime in superphosphate.

The following analyses express the composition of some samples imported into England during the last two years:—

COMPOSITION OF NAVASSA PHOSPHATES.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
Moisture, water of combination, and loss on heating ..	12·08	10·90	13·99	12·55	9·35	10·53
*Phosphoric acid	30·21	31·08	30·04	31·90	31·85	29·60
Lime	35·32	36·54	35·99	36·09	37·91	31·72
Magnesia, carbonic acid, oxide of iron, alumina, &c.	19·65	17·78	17·04	16·91	17·99	25·45
Insoluble siliceous matter ..	2·74	3·70	2·94	2·55	2·90	2·70
	100·00	100·00	100·00	100·00	100·00	100·00
* Equal to tribasic phosphate of lime	65·94	67·85	65·58	69·64	69·53	64·62

13. ST. MARTIN'S PHOSPHATES.

Rock-phosphates are also found on St. Martin, a small island belonging to the group of Windward Islands, situated 18·5° north latitude, and 63·4° west longitude, in the West Indian Sea.

The character of the phosphate deposits on St. Martin varies a great deal, and care and attention have to be exercised in mining and separating the more valuable and richer deposits from the inferior minerals which are intermixed with the coral rock on which the phosphate is deposited.

The variable character of these phosphatic minerals will be recognised by an inspection of the following analyses which I made of a number of samples from St. Martin:—

COMPOSITION OF ST. MARTIN'S PHOSPHATES.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
Moisture and water of combination	5·50	5·15	4·01	2·94	2·26	5·69
Phosphoric acid	36·94	35·69	35·22	31·18	28·38	16·67
Lime	48·87	46·04	50·15	53·48	52·52	40·88
Carbonic acid	2·89	2·65	5·79	10·73	13·04	20·60
Oxide of iron and alumina, &c.	4·78	7·93	4·59	1·14	3·60	11·97
Insoluble siliceous matter ..	1·02	2·54	·24	·53	·20	4·19
	100·00	100·00	100·00	100·00	100·00	100·00
* Equal to tribasic phosphate of lime	80·64	77·91	76·88	68·07	61·95	36·39
† Equal to carbonate of lime	6·57	6·02	13·15	24·39	29·63	46·81

The samples No. 1 and No. 2, it will be seen, contained but little carbonate of lime, and a high percentage of phosphate of lime. No. 3 contained more carbonate of lime, but was rich in phosphate of lime, and must be considered a high-class phosphate. In No. 4 the proportion of carbonate of lime rose to 24 per cent., and that of phosphate of lime receded to 68 per cent. Although rather too much contaminated with carbonate of lime, it was still of a quality which finds a ready sale in England. No. 5, on the other hand, was of too poor a quality to bear the expense of freight, and No. 6 was practically useless and unsaleable in this country, as it contained a higher percentage of carbonate than phosphate of lime.

The following are more complete analyses of two samples of St. Martin's phosphate:—

DETAILED COMPOSITION OF TWO SAMPLES OF ST. MARTIN'S PHOSPHATE.

	No. 1.	No. 2.
Moisture and water of combination	5·04	3·56
*Phosphoric acid	24·14	35·13
Lime	47·69	50·41
Magnesia	·38	·22
Sulphuric acid	·18	·45
†Carbonic acid	14·20	6·59
Oxide of iron	1·51	1·40
Alumina	2·99	1·37
Insoluble siliceous matter	3·87	·87
	100·00	100·00
* Equal to tribasic phosphate of lime	52·70	76·69
† Equal to carbonate of lime	32·27	14·98

The sample, No. 1, contained only 52 per cent. of phosphate of lime in round numbers, and was so much mixed up with coral rock (carbonate of lime) that it was unsaleable; whereas No. 2 contains a high percentage of phosphate of lime, but little oxide of iron and alumina, and not too much carbonate of lime to prevent its being classed with high grade mineral phosphates.

14. Aruba Island Phosphates.

Another phosphatic rock or mineral has recently been discovered on Aruba Island, one of the Leeward Islands in the Caribbean Sea, situated 12° 36′ north latitude, and 70° 8′ west longitude.

In 1824 gold was found on Aruba, a Dutch possession, and is at the present time explored by the Aruba Gold Mining Company, who have also recently obtained a concession from the Dutch Government to work and export the newly discovered phosphatic mineral deposits on that island.

The samples of Aruba rock phosphate which have come under my notice are compact hard stone-like masses of a light-brown or yellowish colour, with darker chocolate-brown coloured bands and blotches, which give the Aruba phosphate a peculiar and characteristic appearance. Veins of calc-spar not infrequently interlace the phosphatic mineral, which probably will be found even a more valuable acquisition than the gold-mines. Aruba phosphate, I find, contains from 63 to 76 per cent. of phosphate of lime, with variable quantities of carbonate of lime, oxide of iron, alumina, insoluble siliceous matter, and similar impurities usually found in phosphatic minerals. In illustration of the chemical character of Aruba phosphate, I subjoin analyses of several samples which have recently been submitted to me for examination:—

Composition of Five Samples of Aruba Phosphate.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Moisture and water of combination	5·55	3·79	5·54	3·79	5·48
*Phosphoric acid	31·11	33·04	28·95	33·04	34·94
Lime	41·69	47·53	30·18	47·53	42·91
†Carbonic acid	6·69		·98		
Oxide of iron	14·72	14·60	9·26	14·60	16·43
Alumina, &c.			17·22		
Insoluble siliceous matter ..	·24	1·04	7·87	1·04	·24
	100·00	100·00	100·00	100·00	100·00
* Equal to tribasic phosphate of lime	67·91	72·13	63·20	72·13	76·28
† Equal to carbonate of lime	15·20	..	2·23		

One sample, No. 3, it will be seen, contained a good deal of oxide of iron and alumina, and for this reason was not well adapted to the manufacture of superphosphate. The remaining samples also contained appreciable quantities of oxide of iron and alumina with more or less carbonate of lime. Three of the samples contained as high a percentage of phosphate of lime as is found in the best samples of Sombrero Rock phosphate, which the Aruba mineral resembles closely in its chemical composition.

There are a number of other small islands in the Caribbean Sea on which rock phosphates of more or less value occur. For instance, on Pedro Keys a phosphatic deposit is found, in a cargo-sample of which I found :—

Composition of a Sample of Pedro Keys Phosphate.

Moisture and water of combination	9·34
*Phosphoric acid	29·69
Lime	36·01
Oxide of iron and alumina, magnesia, carbonic acid, &c.	19·69
Insoluble siliceous matter	5·27
	100·00
* Equal to tribasic phosphate of lime	64·81

This is an inferior mineral phosphate, and not often met with in commerce at the present time.

15. Redonda Phosphate.

Some years ago a peculiar phosphate, mistaken at the time for phosphate of lime, was discovered on the Redonda Island.

This mineral consists principally of hydrated phosphate of alumina, contaminated with more or less oxide of iron and insoluble siliceous matter. Most samples contain no lime whatever, and in consequence Redonda phosphate cannot be used in the manufacture of ordinary superphosphate of lime.

It is, however, utilised in chemical works for the production of alum, for which several patents have been taken out in England, and it yields, as a by-product in the manufacture of alum, impure phosphoric acid, which may be incorporated with salts of ammonia and other fertilising materials, and thereby be transformed into artificial manures. Redonda, and other kinds of crude phosphate of alumina, are also useful after treatment with sulphuric acid, as precipitating and clarifying agents of town sewage.

Messrs. Forbes and Price, who have patented the employment

of a solution of crude phosphate of alumina in sulphuric acid, recommend to mix the finely powdered mineral with a sufficient quantity of sulphuric acid to render the phosphate of alumina and iron soluble. A small quantity of the solution thus obtained and diluted with some water, these gentlemen recommend to be poured into foul town sewage, and at the same time to add a little milk of lime, when an immediate flocculent precipitate is formed, which readily settles at the bottom of the precipitating-tank, carrying down with it all the suspended organic matter and a portion of the soluble organic impurities of town sewage, and leaving the supernatant liquid almost colourless, fairly clear, and inoffensive to smell.

The dried sewage deposit consists of a mixture of precipitated phosphates of iron, alumina, and lime, and contains also more or less organic matters (yielding ammonia on decomposition), and fine sand, and similar mineral insoluble impurities present in town sewage. It constitutes a useful artificial manure.

The following are the results which I obtained from the analysis of four samples of Redonda phosphate :—

Composition of Four Samples of Redonda Phosphate.

	No. 1.	No. 2.	No. 3.	No. 4.
Moisture and water of combination ..	23·23	21·15	27·70	24·20
*Phosphoric acid	36·95	37·04	19·40	38·52
Alumina and oxide of iron	36·38	32·26	25·65	35·33
Insoluble siliceous matter	3·44	9·55	27·25	1·95
	100·00	100·00	100·00	100·00
* Corresponding to tribasic phosphate of lime	80·66	80·86	42·35	84·09

The samples Nos. 1, 2, and 4, it will be seen, were very rich in phosphoric acid; No. 3 represents the composition of an unusually poor sample of Redonda phosphate.

16. Alta Vela Phosphate.

Alta Vela Rock phosphate is found on the small island of Alta Vela near St. Domingo, and is another form of crude phosphate of alumina, which may be used for the same purposes for which Redonda phosphate is employed. It appears to vary in composition to a greater extent than Redonda phosphate.

The following is an analysis of a sample of inferior Alta Vela phosphate :—

Composition of a Sample of Alta Vela Phosphate.

Moisture	10·64
Water of combination	5·85
*Phosphoric acid	20·45
Lime	11·29
†Carbonic acid	4·01
Oxide of iron	5·76
Alumina	13·48
Insoluble siliceous matter	28·52
	100·00
* Equal to tribasic phosphate of lime	44·64
† Equal to carbonate of lime	9·11

This sample was evidently a mixture of phosphate of alumina with phosphate and carbonate of lime, and a good deal of insoluble siliceous matter.

Other samples I have found free from lime, but in all hitherto analysed by me I have found a considerable proportion of insoluble siliceous matter. On the whole, Redonda phosphate is richer in phosphoric acid than Alta Vela phosphate, as will be seen by the following results of analyses made in my laboratory :—

Composition of Three Samples of Alta Vela (St. Domingo) Phosphate.

	No. 1.	No. 2.	No. 3.
Moisture	18·51	19·33	4·19
Water of combination			12·99
*Phosphoric acid	20·07	26·23	10·86
Oxide of iron	7·38	7·23	2·79
Alumina	21·20	20·22	21·98
Insoluble siliceous matter	32·84	26·99	27·19
	100·00	100·00	100·00
* Corresponding to tribasic phosphate of lime	43·81	57·26	67·37

Alta Vela phosphate is a harder rock than Redonda phosphate, and of a lighter colour.

Conclusion.

All the minerals described in the preceding pages are of little use for agricultural purposes, except when they are treated with sulphuric acid. I am aware that some, for instance, German phosphates, have been usefully applied to the land simply in a finely powdered state, and no doubt in the immediate neighbourhood where phosphatic minerals of a low quality are found, and

are procurable at a trifling expense, they may be used with advantage in a powdered state, like marl, in large quantities, say at the rate of a ton or more per acre; but as a rule, phosphatic minerals are mainly of use to the manufacturer of superphosphate, whose aim it should be to render, by treatment with sulphuric acid, the insoluble phosphate of lime contained in them as completely soluble in water as possible.

Soluble phosphate of lime is a definite chemical compound, and in all respects just as valuable for manuring purposes as soluble phosphate obtained from bones. On the other hand, insoluble phosphate, in the shape of undecomposed phosphatic minerals, has little or no practicable manuring value, whilst in the shape of bone-dust it is sufficiently available as plant-food to be of considerable value.

In conclusion, I shall briefly revert to the various conditions which affect the commercial value of phosphatic minerals as raw materials for the manufacture of superphosphate and compound artificial manures.

The commercial value of phosphatic minerals is obviously regulated by the percentage of phosphate of lime they contain. The richer they are in this element, I need hardly say, the more valuable they are, other circumstances being the same, to the manufacturers of artificial manures.

But the percentage of phosphate of lime alone is not the sole measure of their commercial value; and it not infrequently happens that a phosphate having a lower percentage of phosphate of lime, nevertheless is worth more, weight for weight, than another kind richer in phosphate of lime; for whilst some impurities, for instance, quartz rock and insoluble siliceous matters, do not consume any sulphuric acid, others, like carbonate of lime, neutralise or render ineffective a portion of the acid which is employed in the manufacture of superphosphate for rendering the phosphate soluble. Any excessive proportion of carbonate of lime in a mineral phosphate, therefore, detracts from its value. A moderate percentage of carbonate of lime, however, is rather beneficial than disadvantageous, inasmuch as the carbonic acid which is disengaged from the carbonate when the powdered mineral is treated with acid has a tendency to make the superphosphate more porous and bulky, and finally to produce a manure in a better mechanical condition than it can be obtained from minerals altogether destitute of carbonate of lime.

Again, the commercial value of phosphatic minerals is affected in a great measure by the percentage of oxide of iron and alumina which they contain; that is to say, the unit per cent. of phosphate of lime is worth more in minerals which contain

little or no oxide of iron and alumina than in others containing a good deal of iron or alumina. The percentage of fluoride of calcium which accompanies most phosphatic minerals likewise affects their commercial value; and in a minor degree their value is further affected by their porosity or density, and the facility with which they can be reduced to a fine powder.

Laboratory, 11, *Salisbury-square*, *Fleet-street*, *E.C.*,
July, 1875.

XVII.—*Notes on the Works of Sowing and Consolidation of the Dunes or Coast Sand-hills of Gascony, containing information obtained from M. A. Chérot, a French Economist, with a view to the introduction of similar works on the Sand-drifts that are rapidly advancing over and threatening eventually to destroy the City of Beirût.* Communicated by General F. Cotton, C.S.I.

The sand-hills which run along the shores of the Gulf of Gascony, and which have been fixed by the process of Brémontier, extend from north to south from the mouth of the Garonne to the mouth of the Adour, having a length of nearly 120 miles and a mean breadth of 3 miles.

Before they were fixed by the plantations which have been recently made, they advanced each year toward the interior. No effectual obstacle to their encroachment having been found, they covered all the buildings lying in their path; and had buried up to the belfry the old church at Soulac, when Brémontier undertook to fix these masses of sand, and to arrest their progress into the interior of the country.

The essential part of the system adopted consisted in sowing the dunes with pine-seed; but as the sands were displaced every day by the winds of the coast, it was necessary, to ensure a successful sowing, to employ certain means invented by Brémontier, without which no vegetation could have obtained a hold upon these moving masses.

These precautions are shown in a detailed and exact manner in the annexed Specification.

The sowing, as appears in the Specification, is usually made with a mixture of the seeds of the pine and of the broom-plant.

The broom comes up first, and, before the protection of the branches (brushwood) has ceased to be efficacious, it covers

the surface with a growth of vegetation which is a more perfect protection than the brushwood which first gave it shelter.

The pine-plants come up much more slowly, and grow, by slow degrees, under the shelter of the broom; but at the end of three or four years, or five at most, the pines will have outstripped the broom, and become sufficiently strong to make the fixing of the sand complete; their growth chokes the broom which first protected them, and which now, having become useless where it is, is made use of as brushwood to cover parts newly sown.

When the pines have thus choked the broom, the object is gained—the dune is secured; no further work is required except to clear out the plantation in proportion to the growth, so as to secure the healthiness of the remaining plants, and thus obtain a forest-produce of great value, from the ground which was previously nothing but a danger to the country.

The produce of the first thinnings served also as brushwood, and, together with the broom-plants which had been cut, afforded shelter which enabled the process of sowing to be continued.

It is chiefly because the whole of the work has been so directed, that from the portions already done, in proportion as they were completed, the means required for continuing the sowing were obtained, so that it was possible to finish the whole work without great expense.

The average cost of sowing the sands under this system amounted to 47*s.* per acre, including all additional works, particularly those of fencing, which were needed to protect the parts first sown from the still drifting sands near them, which had not yet been fixed.

If, in order to bring the work to a more rapid conclusion, the supply of branches or brushwood had been sought for elsewhere, the expense would have been double. This increase will be easily understood if it is remembered that the sands were on the border of a flat plain, on which there were no plantations, and that the brushwood must have been brought from a distance; and the carriage would have been the more expensive, because in certain parts of the dunes the brushwood must have been carried on the back of mules.

The Specification provides for certain works to be done to protect the parts sown, while the process of fixing is still going on, from the sand which might be carried over them by the wind. Palisades, or wattled fencing with stakes, or of simple branches, should be placed round the threatened parts.

The palisades of planks are more costly at first, but they are much more effective than the wattled fencing; and as the planks last much longer, the final expense of the palisades is

generally not higher than that of the wattled fence; they have also been found better, and it is recommended that they be used in preference.

The "gourbet" (*Calamagrostis arenaria*), Syn: *Ammophila arenaria*, which is ordered to be mixed with the broom and with the pines in places most liable to be invaded, is a hardy plant, and does not suffer from the proximity of the sea; and it has, besides, a special quality valuable for the purpose in view, which is, that in proportion as the sand accumulates round its stem it continues to grow without injury, while almost all other plants are killed when the sand is raised above the crowns of their roots. The gourbet has been known to continue to grow vigorously after it had been covered slowly with more than 8 feet of sand since it was sown. The stem of the plant buried in the sand was nearly 10 feet from the end of its root.

The gourbet is, as we have said, a very hardy plant; and as it grows at all seasons, and is not affected by either heat or cold, there is no doubt that it would suit the climate of Beirût.

The sea-pine which grows on the dunes of Gascony is a species which succeeds marvellously in the climate of the south-west of France; and besides the timber, it gives a considerable produce in resin, so that it has naturally been chosen in a climate which suits it so well; but it has not succeeded except in a temperate climate, and does not do well either in great heat or cold. I am strongly of opinion that it would not be grown easily at Beirût; but other species might be found there, more suited to the climate, which might be substituted with advantage for the sea-pine. The residents in that country are more competent than I can be to know which would be the most suitable species. The process of sowing and fixing the drifting sands would in other respects remain the same, whatever be the species of pine made use of.

The dunes which have been sown in the departments of the Garonne and of the Landes are, I believe, the highest on the sea-coast. Their mean height is from 160 to 230 feet. There are some in the middle of the chain which attain the height of 260 and 300 feet.

The total surface of the dunes in the two departments is over 200,000 acres.

The work of fixing these dunes, begun by Brémontier, was continued by the engineers who succeeded him, according to his system, and was completed in 1862 over the 200,000 acres.

The system invented by Brémontier is shown in the annexed Specification. It has always been applied with the same success. I have often seen, during the progress of the work, the most violent storms, producing the greatest destruction in the dunes

that had not then been planted, carrying them forward more than 60 feet; but those completed were not damaged, and those under the operation were so little injured that they were restored in two or three days after the storm.

The expense, as already stated, has been about 47*s.* per acre, or for the whole extent, over 480,000*l.*

The value of the dunes when planted may be estimated at 16*l.* per acre, when the pines begin to yield the resin.

These 200,000 acres of moving sands, which were previously so great a danger, are now covered by a magnificent forest, which in a few years will be worth about $3\frac{1}{2}$ millions sterling.

General Specification for Fixing and Sowing part of the Dunes or Sand-hills in the Commune of La Teste.

The works of fixing and sowing the dunes consist: 1st, in spreading the seeds; 2ndly, in covering the moving sands by means of branches (brushwood); 3rdly, in sheltering the parts sown from the encroachment of outside moving sands.

1. Sowing.

1. The sowing of each acre of dune to be made with 18 lbs. of pine-seed and 7 lbs. of broom-seed, to which must be added $4\frac{1}{2}$ lbs. of the seed of "gourbet," *Calamagrostis* (*Ammophila*) *arenaria* (*Arundo arenaria*, Linn.), when the dunes are very moveable, and much exposed to the action of the sea-winds.

2. These quantities of seeds to be separately and evenly sown immediately before the spreading out of the brushwood, in order that they may not be clogged together or dispersed by the wind.

3. The gourbet-seed only to be used on the borders of the sowings in those parts where the defences fail to give complete protection from the outside drifting-sand.

4. Each acre of dune to be sown with gourbet to have only 13 lbs. of the seed of that plant, which is to be mixed with wet sand, so that it may not be carried away by the wind when it is sown broadcast.

5. The sowings may take place at all seasons, if necessary to obtain the payment of instalments of the contract price; but it is better to make them, as much as possible, from the 1st October to the 30th April.

6. As a rule, the sowing must not be made on the steep slopes of the sand-hills, except during the summer, when the sand is perfectly dry; and care must be taken, besides, that it is firmly trodden down by the workmen, that the slope may be lengthened, and that the sands lately carried up by the wind may not slip down, dragging off the coverings.

7. The seeds to be of the best quality. Those obtainable in the trade cannot be trusted. To escape all fraud, they should not be used unless approved by the manager.

2. Covering.

8. The seeds to be covered with brushwood, cut in fan-shape; and for this purpose all the small branches or twigs above or below, which would prevent the branches being laid flat on the soil, to be struck off with some sharp instrument; and the stems of the branches, where bent or twisted, to be made straight by notches cut half through them before they are laid down.

These branches to be applied as evenly as possible on the surface, and laid overlapping one another, as the feathers on the body of a bird. These coverings

to be kept in their place by shovelfuls of sand thrown on them at the distance of nearly 10 inches from one another.

9. On the steep slopes, the brushwood branches, as they cannot be fixed by sand on them, to be cut and laid on, as just described, and the thick ends of the branches to be stuck into the sand to the depth of 4 inches.

10. For each acre of the dunes to be sown with pine and broom-seed, 600 faggots of brushwood, of $22\frac{1}{2}$ lbs. each, to be used; but only 300 faggots for the parts laid down with gourbet, or for the fixing of the *lettes** of sand which are not sown.

11. The branches to form these faggots not to be much thicker in the stem than 1 inch, and to have all their leaves on them. To be cut at least twenty days before being used from the 1st November to the 1st April, and ten days for the rest of the year.

12. All the labourers employed in the preparation and laying down of the brushwood, as well as in sowing the seeds on the dunes, to be superintended by an intelligent head workman, well instructed in the duty.

13. The contractor to begin the sowing on the dunes at the southern extremity, and doubling back towards the north by parallel zones of sowing facing the south-west.

3. Works of Defence.

14. When necessary to protect fresh sowings from the encroachment of drifting sand, lines of palisades, or of wattled or other fencing, to be fixed in the direction to be marked out by the foreman of the works, according to the more or less exposed situation of the parts.

15. These palisades to be made of 1-inch boards of a height of 5 feet, and a breadth of from 6 to 8 inches. A space to be left between each of $\frac{3}{4}$ths of an inch, and the boards to be fixed to the depth of 2 feet.

These boards to be of pine-wood, tarred, of very good quality, well smoothed on the sides, and without flaws.

16. The wattled fencing to be either single or double. The first to consist of a row of stakes of a mean diameter of $2\frac{1}{2}$ inches, of 5 feet long, fixed in the sand, 20 inches deep, with spaces between of 20 inches from centre to centre, and wattled and raised above the ground to the height of 40 inches. For the double wattling the stakes to be 8 feet long, and 3 inches of mean thickness; but at first only to be wattled to the height of 40 inches from the bottom, so as to leave an equal height for a second wattling when the first shall be overtopped.

17. The other fencing (*cordons*) to be made of bundles of picked brushwood of 8 inches diameter at the bottom, and 28 inches at the least in height, planted in fives (*en quinconce*) in two or three rows, according to necessity, and fixed a foot deep in the sand.

18. The direction of the lines of defence for the sowings to be regulated in each particular case upon the following principles:—

1st. In general the working-plot (*l'atelier*) should be placed on the west of the dune next the shore, upon a sowing already made, or on a secured *lette*. This condition being fulfilled, if the two ends are not closed they must be secured by lines of defence, narrowing from the space between, against the danger of the winds blowing from points between the north-west and south-west. These will have a direction following as much as possible these two lines, the opening of the angle which they form being turned towards the sea.

* *Lettes* are certain parts of the sea-coast which are surrounded by sand-hills, but not covered by sand. They are patches where the moisture arising from defective drainage of rain-water, encourages a low herbaceous growth, which adds still more to the fixing of the soil. They thus form a good starting-point for fresh works.

2nd. When a sowing shall be protected on the north, the lines of defence on the south-end will follow the direction of south-west.

3rd. In the opposite case, where the working-plot is open on the south end, the direction of the lines of defence will be to the north-west.

19. The contractor may in some cases be obliged to deviate from the general principles laid down above, but is never to be permitted, for one instant, to leave any part of his workyard, when it adjoins the moving sands, with its sides exposed and unprotected from the danger of the winds.

20. The parts at the end of a sowing on the west side which cannot be joined to the shore dune, or to a protected *lette*, or to a sowing previously completed, to be secured by works of defence.

21. Palisades of planks to be used for these parts, and for the most exposed points on the sides of the sowings. The cordons of bush-fences to be kept for the foot of the dunes overhanging the *lettes* of sand.

22. If the movement of the dunes outside the limits of the work undertaken should threaten the sowings, the contractor must warn the engineer beforehand, so that the authorities may take the measures necessary to stop the advance of the sands. Any neglect of this rule will exclude him from any right to indemnity from loss, under pretext that it arose from causes beyond his control.

23. The contractor only to be paid for the works of defence actually completed; and to bear the expense of any preparatory works which he may deem it necessary to set up in the interior of the working-plots to protect the sowings while waiting to continue them to the extent fixed in the contract. He is also answerable for any encroachment or thinner drifts which may take place by the movement of the sands within the limits of his undertaking.

4. Special and General Conditions.

24. The contractor to be responsible for the success of the works, and of their maintenance up to the final payment and approval, which is not to take place until three years after the last sowings have germinated.

For the palisades, the wattle and bush-fencing (*cordons*), the warranting is not to commence till three months after the entire finishing of the work, and its provisional approval.

25. The administration not to admit of any excuse, such as the want of men, the dearness of seed or provisions, the difficulty of transport, or the violent changes of the weather which may have damaged the coverings or have destroyed the plants, as, for example, winds, frost, hail, drought, or other causes whatever by which the contractor might seek to excuse the failure of his sowings.

26. As the contractor should not make a tender until he has previously mastered the substance of all the smaller details, he is to have no grounds for claiming indemnity on the plea that the sources of supply for the brushwood have been overrated, or the distance for transport supposed to be less, or for any other reason founded on the supposed errors of the Specification.

27. Every year a regular statement (*procès verbal*) of the extent of the sowings to be drawn up. This statement to contain observations on the state of the sowings, and to be communicated to the contractor, who must either accept it or state his claims for deduction upon it within ten days.

28. At the principal angles of the spaces sown in each district, under the direction of the superintendent, posts in oak-wood of 4½ inches to 6 inches in the side, and 6½ feet, at the least, in length, to be placed. These posts to be imbedded 4 feet in the ground, and to be inscribed on the top with a red-hot iron, the year of the execution of the sowing, and consecutive numbers. The part imbedded in the ground to have had previously two coats

of tar. The posts to be in oak-wood of the country, squared to a sharp edge, and of good quality.

At the other angles pegs in oak, 5 feet in length and 3 to 4 inches square, to be imbedded nearly 3 feet in the ground, and to be marked with a hot iron in consecutive numbers.

29. The payments to be made to the contractor to be regulated according to the following terms:—

1st. Before the first shooting of the seeds he is not to receive anything except the value of the brushwood-faggots employed for the covering.

2ndly. In the following month of June an examination shall be made. If it is favourable, he will be entitled to receive 90 per cent. of the entire expense incurred; the remaining 10 per cent. to be retained as a guarantee.

3rdly. At the second shoot, or in the month of June following the second year of the sowing, a fresh inspection will be made. If it is favourable, the sum retained for guarantee to be reduced to $\frac{1}{15}$th of the total amount.

4thly. At the third growth, if there are grounds for the provisional acceptance of the work, the guarantee to be reduced to 5 per cent., and to remain so until the end of the operation.

30. The approval or provisional acceptance in each year to be declared favourable to the contractor when the plants shall show:—

The first year, $1\frac{1}{2}$ ft. of pine, and as much broom per square foot.

The second year, 1 foot of each kind.

The third year, $\frac{3}{5}$ths foot of each kind.

31. A certificate of provisional acceptance to be then delivered, and the amount retained for guarantee reduced, as shown above in Article 29.

32. The maintenance of the sowings to remain in the care and at the cost of the contractor until the final approval, in conformity with Article No. 24, and to include replacing the pegs, repairs to the covering, and other works of defence, and the re-sowing found to be necessary after the third provisional acceptance.

33. After the entire completion of the work and the expiration of the periods of the guarantee fixed by Article 24, the deed of final acceptance to be drawn up and the contractor discharged from all responsibility.

34. The Contractor to be always provided with a measuring chain of 33 feet, with twenty stakes of $6\frac{1}{2}$ feet in length, furnished with their sights; also to keep in the workshed an instrument for ascertaining the level of the surface of the sowings executed.

35. He is not to be entitled to any remuneration for pegs, stakes, labourers' wages, or any other extra expenses incurred in marking out the works or in measuring the surfaces of the sowings made.

36. These surfaces to be measured horizontally, without regard to irregularity of the ground or the inclination of the slopes.

37. For the cutting of the brushwood, the felling of trees, and the opening of means of passage for carts, he is to follow the directions which will be given to him by the Agents of the Department of Roads and Bridges. He is also bound to clear out all the stumps of the pines in the sowings whence he shall have taken the brushwood.

38. He is to be responsible for all damage occasioned in the sowings or woods by the labourers employed in the cutting and carriage of the faggots, and liable to the penalties imposed for such acts by the code of forest laws.

39. If the administration desires to make any trials or experiments, the contractor is bound to procure all the plants and all the necessary materials, but not to be responsible for their success.

40. The contractor to fix his residence in the place nearest to the works, or to appoint some one furnished with powers to represent him there.

41. No work to be carried on in the sheds on Sundays and holidays. In

case any exceptional circumstances should occasion a deviation from this rule, the contractor must apply for the necessary permission in sufficient time for the competent authority to consider the necessity.

42. A deduction of 1 per cent. to be made on the contract price of the works for the benefit of the sick or injured workpeople, to secure to them medical assistance in case of need, or of pecuniary help in conformity with the provisions of the Decree of the Minister of the 18th December, 1848, and of the Circular of the 22nd October, 1851.

43. The contractor, besides, to be subject to all the clauses and general conditions imposed on all whose undertakings are accepted by the Department of Roads and Bridges, as in the paper of charges annexed to the Circular of M. le Directeur-General, and dated the 25th August, 1830.

XVIII.—*Report on Laying down Land to Permanent Pasture.* By Morgan Evans, of London, and T. Bowstead, of Eden Hall, Penrith, Cumberland.

Introduction. By Morgan Evans.

The Council of the Royal Agricultural Society determined to obtain information on the following question:—"The alteration in the cultivation of land caused by the present high prices of farm stock, and the increased cost of agricultural labour; attention to be specially called to the laying down of permanent pasture, and the extension of time given to artificial grasses on arable farms." Accordingly, Mr. Thomas Bowstead, of Eden hall, Penrith, and myself were requested to prepare a report on the subject for the Society's 'Journal.' The area included in our investigations was confined to England and Wales. Mr. Bowstead prosecuted his inquiries in the northern division of the country, leaving me to collect materials relating to the south. The information obtained by my colleague was ultimately placed in my hands; and at his request I undertook to write the introductory remarks, and a few concluding observations on the information we were enabled to collect from those practical agriculturists who had kindly responded to our inquiries.

It has for many years been apparent that increased attention was being directed to the production of grass by the farmers of this country. Whilst the price of corn has remained almost stationary, or fluctuated but slightly according to the seasons, the work of producing it has gradually been rendered more costly, from the constantly increasing high rate paid for agricultural labour, and the necessity of employing expensive machinery in the cultivation of the soil. On the other hand, the price of meat has been continually advancing; and by

converting arable land into pasture a considerable reduction in the labour bill may be obtained. These conditions have had the result of inducing many farmers throughout the country to enlarge their area under grass and to diminish that under corn; in some cases by laying down land to permanent pasture, and in others by a more extended period for artificial grasses in the rotation. The following Table, compiled from the official agricultural returns, gives the acreage of arable and permanent pasture in England and Wales from the years 1870 to 1874 inclusive. It is needless to extend our inquiries further back, as previous to 1870 the classification of grass under rotation and under permanent pasture was not so correct as that which has been followed since the year 1869.

ACREAGE of ARABLE and PERMANENT PASTURE LAND respectively, in ENGLAND and WALES, in each Year, from 1870 to 1874.

ARS.	ENGLAND.		WALES.		TOTAL FOR ENGLAND AND WALES.	
	Arable.	Pasture.	Arable.	Pasture.	Arable.	Pasture.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
70	13,729,000	9,680,000	1,120,000	1,428,000	14,849,000	11,108.000
71	13,836,000	9,882,000	1,110,000	1,495,000	14,946,000	11,377,000
72	13,839,000	9,991.000	1,104,000	1,532,000	14.743,000	11,523,000
73	13,656,000	10,238,000	1,065,000	1,582,000	14,721,000	11,820,000
74	13,570,000	10,438,000	1,045,000	1,634,000	14,615,000	12,072,000

It will thus be seen that a considerable addition has gradually been made during the last five years to the acreage under grass in England and Wales. We were, however, in 1873, warned by Mr. R. Valpy, of the Statistical Department, that as to the additions annually or periodically made to the cultivated area of the country, or as to the relative variations in the extent of arable or grass farming, the agricultural returns do not as yet afford any very decided evidence. The returns must extend over a longer period of years than they yet do before marked proofs of changes in these respects can be looked for. The more complete collection of the returns, and greater care in returning the particulars required, have doubtless caused a large part of the apparent increase. There is, nevertheless, according to the reports of the collecting officers, an addition annually made to the cultivated acreage of the country by the reclamation of land, which is necessarily a rather slow and expensive work in most parts of

the country. The larger part of the increase in the total quantity of land is for permanent pasture; and here a large allowance must be made for additions due to more accurate returns under that head. Mr. Valpy, however, says that "the higher cost of agricultural labour, together with the increased demand, and remunerative prices obtained, for butchers' meat and dairy produce, are mentioned by several of the collecting officers as causing a change from arable to grass farming."

As might be expected, with the increased production of grass more live stock is kept each succeeding year, as is shown in the Table on the opposite page.

In five years it appears that the increase in cattle has been 508,662; in sheep, 1,277,719; in pigs, 260,094; and in horses, 37,083. The total proportionate numbers of live stock in England and Wales to every 100 acres of land under crops, bare fallow, and grass, in 1871, were 4·1 head of horses, 15·5 head of cattle, 73·9 head of sheep, and 8·8 head of pigs. In Wales the proportions were —horses, 4·5; cattle, 22·9; sheep, 103·9, and pigs, 8·7. In 1874 we find that for every 100 acres used for agricultural purposes, there were in England, 4·2 head of horses, 17·9 head of cattle, 82·7 head of sheep, and 8·6 head of pigs: in Wales, 4·6 horses, 24·8 cattle, 114·4 sheep, and 8·0 pigs. It should be remarked that the larger proportionate numbers of cattle and sheep in Wales as compared with England are owing to the extent of rough pasturage upon heath and mountain-land in the Principality not included in the returns under the head of permanent pasture. How much of the increase in the number of live stock reported is due to more correct returns it is difficult to say. But taking the figures as given, it will be seen that although the number of horses and pigs to every 100 acres has remained almost stationary, there has been an increase in England of 2·4 cattle and 8·8 sheep; in Wales, of 1·9 cattle and 10·5 sheep. Or, to put it in another light, there are now kept on every 100 acres of land in England more than one-seventh more cattle than in 1871, and one-ninth more sheep; whilst in Wales the increase has been at the rate of adding one-twelfth more cattle and about one-tenth more sheep. Looked at from any point, the increase is encouraging; and, coupled with the fact of the large extension of area under grass, there appears to be little doubt that the additional number of live stock maintained by the country is principally due to the greater attention paid to the production of grass.

Notwithstanding the enhanced price of labour, and the increased demand for stock, both lean and fat, the extent to which arable land has been converted into pasture has not been so sudden nor so great as might naturally have been expected. Farmers have hitherto been slow to alter their usual course of husbandry at the

SUMMARY of TOTAL NUMBER of LIVE STOCK returned in ENGLAND and WALES, in each Year from 1870 to 1874.

Live Stock.		1870.	1871.	1872.	1873.	1874.
		Number.	Number.	Number.	Number.	Number.
Cattle	England	3,757,134	3,671,064	3,901,663	4,173,635	4,305,440
	Wales	604,749	596,588	602,738	642,857	665,105
	England and Wales	4,361,883	4,267,652	4,504,401	4,816,492	4,970,545
Sheep	England	18,940,256	17,539,407	17,912,904	19,169,851	19,859,758
	Wales	2,706,479	2,706,415	2,867,144	2,966,862	3,064,696
	England and Wales	21,646,735	20,236,822	20,780,048	22,136,713	22,924,454
Pigs (exclusive of those kept in towns and by cottagers with less than half an acre of land.)	England	1,813,901	2,078,504	2,347,512	2,141,417	2,058,781
	Wales	198,547	225,456	238,317	211,174	213,754
	England and Wales	2,012,448	2,303,960	2,585,829	2,352,591	2,272,535
Horses (including Ponies), as returned by occupiers of land.	England	977,707	962,840	962,548	979,012	1,007,398
	Wales	116,131	117,176	118,266	120,273	123,523
	England and Wales	1,093,838	1,080,016	1,080,814	1,099,285	1,130,921

indication of changes in market-prices. Even the steady influence of years of experience, clearly tending to demonstrate a growing and apparently permanent alteration in the price of a special product of the farm, has failed to produce great variations in the routine of cropping. Changes in the area under cultivation of a particular class of plants, or in the usual average amount of live stock of any kind on the farm, have hitherto been but slowly made, and with a caution amounting to timidity. Whatever competent observers may have prognosticated as the probable price of wheat, barley, or oats for the next few years, the farmer, although he may have already received a foretaste of the future, has deviated little from his path. By pursuing his usual course he believed himself to be at least safe, and that in the end he must win. In past times he found that a few seasons at most were sufficient to balance a temporary reduction in the value of any article. If there was a fall this year in the price of wheat, it would most probably rise in the next. If horses or sheep, oxen or pigs, were dear, it was only for a time. The rise of the market was only temporary. Its occasional fall, although sudden and sometimes alarming, lasted but a short while. Every commodity had, in its turn, its share of favour. Whenever he did breed more pigs or grow more barley as a speculation he was usually wrong, and got sick and faint-hearted at his ill-luck. On the whole, he found that to adhere to his usual practice of mixed farming was the safer plan, and he always had some kinds of produce that fetched a good fair price, though others hung heavily on his hands, and had to be disposed of at an actual loss. So his theory was "a bit of everything pays best," and in mixed husbandry he found his security and his rent.

Since, however, our country is becoming less self-supporting from the rapid increase of our population; and since rapid means of information have enabled foreign merchants quickly to acquaint themselves of our wants, and operate on our markets, thus keeping prices at a more level rate, the agriculturist can more safely calculate on the prospects of the future. From all we do know, it appears evident that for some time to come the price of meat, at least, will suffer no serious reduction; for the area from which we can import live-stock with profit is very limited compared with the vast territories, many thousands of miles distant, from which we can obtain corn. Under present conditions a crisis in the rise or fall of grain or stock cannot occur so frequently as of old. Formerly the fluctuations were commonly but local phenomena. Now markets are more equalized over the kingdom. And the very slowness with which agriculturists even now take to any change in their system of farming is itself a safeguard against any sudden alteration in the price o

home products from an augmented home supply. To the individual farmer, however, who is quick and enterprising, the very immobility of farmers in the aggregate is an advantage. He need not fear that the whole country will change its farming policy simultaneously. The commercial spirit, which readily adapts itself to the times, is possessed by comparatively few; and the few gain by striding in advance of the footsteps of the many.

Assuming only, for the present, that in the majority of cases an increase of the permanent pasture of the farm is a desirable object, and that the farmer is not ignorant of the benefits of a change in this direction, there are several considerations, any one of which may affect his willingness or ability to deviate from his usual system of cultivation. Besides the natural habit of many English farmers, there are not a few who are wanting in the necessary skill and managerial ability to readily alter their practice to suit special occasions. The order of working to which they have been accustomed they have pursued for a length of time. The whole parts of the machine, so to speak, have become adjusted to one another, so that they find no difficulty in continuing their usual course. Each has by experience attained an accurate knowledge of the capabilities of his own farm. He knows precisely what amount of stock it will carry, how many acres of turnips or hay will sustain the usual number of animals kept, and how many men and horses are required to do the usual work. And as an alteration in the proportions of his crops on a large scale necessitates new calculations as well as an increased effort, he prefers to continue the routine he has always practised.

Then there are many persons so enamoured of a special rotation of cropping—say the four-course—that to extend the period of artificial grasses appears to them a violation of all the true principles of scientific farming. The four-course system is their only ideal of modern practical agriculture, the test by which they judge the claim of others to be admitted into the "hierarchy" of agriculture—to borrow a Disraelian epithet. A course of cropping which has been found highly beneficial in some of our most famous corn-growing districts is supposed to be the only legitimate system to be pursued by intelligent farmers everywhere. It took a long time to establish the general merits of the four-course rotation; and, however powerful the reasons may now be for diverging from the time-honoured precedent, it will probably take a corresponding length of time before any other system becomes equally as general in the country. The philosophy of the four-course shift of alternate white and green crops is well understood. It is perhaps the best natural system of cropping, and of maintaining the fertility

of the soil at the same time. But considerable latitude may be allowed in the present day, such as might have proved injurious before a large consumption of artificial foods, and an expensive application of artificial manures, became general, and before the present improved machinery had been introduced. Two years' grass in the rotation may have a tendency to encourage couch and render the land foul; but a little extra care, with the use of some of the excellent cultivating implements now to be had, ought to enable farmers to completely master this difficulty. One thing may at least be maintained, viz., that there is not the same danger of exhausting the soil by two years' grass as by two years' successive corn crops.

On the whole there appears to be a want of pliability in our system of agriculture. Many persons are the servants, not the masters, of their farms. A farm should be a machine, easily regulated in any part, each provided with its own stop and back action, and having adjustable movements for giving either a large or small delivery of any one produce according to the state of the market or the altered circumstances of the times. But the successful direction of a farm after this method requires foresight and managerial ability; and even if there were more freedom of cultivation allowed by the general consent of the owners of the soil, there are numbers of tenants who would not, and others who could not, take advantage of it.

The cost of converting arable land into permanent pasture, and the length of time necessary before the operation is completely remunerative, also doubtless prevent many persons from undertaking it. When land is laid down to grass, it is, above all, important that it should be well done. It is not sufficient simply to stop short in the rotation just where the usual one year's seed-shift alternates in the course of cropping, and let the land remain in grass ever after,—even though Timothy, cock's-foot, meadow fescue, and Dutch clover, be substituted for the usual clover and rye-grass in the mixture of seeds. The land must be laid down in good heart, and in a proper mechanical condition. This requires expensive manuring, and a preparation of the soil for several seasons beforehand, or else a costly cultivation immediately preparatory to seeding down. Added to this, it is indispensably necessary that the land should afterwards be liberally manured for several years, to enable the plants to obtain firm rootage in the soil, to stimulate the growth of natural grasses, and to form a good "sole," whereby they may be held and nourished for the future. Although heavy crops of grass are raised for the first two years, when the operation is properly conducted, there appears to be a general agreement that in the third and fourth years there is a considerable falling off just

when the artificial grasses are giving way and dying out, and before the natural grasses indigenous to the soil have become thoroughly established. The benefit to be derived does not usually set in until the sixth or seventh year; that is, if we consider the first two years as only so much artificial grass as might be obtained in the usual way in a rotation of crops.

It is evident, therefore, that the change is accompanied by considerable outlay of capital, the profit from which is not immediate, as in the case of corn or root-crops. It is not one of those processes which turns in the ready penny and gives quick returns. One has to labour and to wait before any profit on the outlay is realized. Many farmers are not prepared to invest capital in the soil which shall be inactive for more than a season, or to incur a heavy expenditure in any one direction for the sake of a permanent improvement. Often, indeed, there is a lack of capital—an all-sufficient excuse;—and even tenants who are possessed of ample means will not invest them unless they have ample security; tenants from year to year, especially, cannot be expected to undertake the trouble and expense of making permanent pastures without aid from the landlord, or without protection of their investment. Even with compensation for unexhausted improvements, should the farmer be compelled to leave his holding at the critical stage in the third or fourth year of the newly laid pasture, he might probably receive very inadequate repayment, from the difficulty of appraising the improvement. Under a yearly tenancy it is clearly the duty of the landlord to take a large share of the expense. One witness in the following reports (Mr. D. Christy) says:—"It will scarcely answer the purpose of any farmer to lay down permanent pasture without the landlord's assistance" (p. 488). Another (Mr. Peter Purvis) says:—"I should decidedly say that, as a general rule, no occupying tenant can do so [lay down old arable fields for permanent pasture] advantageously, as it will take a life-time to make good old pasture out of old arable land, and at such an expense as no tenant, even upon an ordinary lease, would encounter" (p. 488). These are possibly extreme opinions of the expense and difficulty of forming permanent pastures, and appear to be founded on exceptional experience. It is certain, however, that the proper laying down of land to permanent grass is everywhere accompanied with considerable labour and expense, and the operation is of that prospective character that demands assistance from the landlord or protection to the tenant. Mr. John Coleman says that, in laying down land to grass, it is the custom in some parts of Yorkshire "for the landlord to provide seeds and manure, charging 5 per cent. on the outlay, and of course claiming the land as grass

ever afterwards" (p. 460). He then adds, "I think a better plan is for the tenant to do the work himself, as the land then remains as arable in the schedule of his agreement, and he can either plough the ground out again, or leave it to be taken at a valuation by his successor as pasture land." In the case of a lease, or a two years' notice to quit, the latter arrangement may be deemed satisfactory; for the tenant, in ploughing his ground out again, would be enabled to recover part, at least, of his capital in the large yield of corn obtained from inexpensive cropping during the last years of his tenancy. But this "ploughing out" would be simply running the land out to its former condition. As this would be injurious to the welfare of the farm, the landlord would probably deem it to his advantage to recompense the tenant, to prevent him from undoing his former good work.

It is almost unnecessary to state that peculiarities of soil and climate are important influences controlling the amount of pasturage already in existence, and determining the advisability of enlarging the acreage of grass land, especially by way of permanent pasture. The so-called corn-growing counties are such because they are naturally more suited to the growth of corn than to that of grass, and not in consequence of local fashion or peculiar notions of agriculture; and they must ever remain of the same relative character when compared with other parts of the kingdom. Climate and geological formation have prescribed the plan on which they are to be cultivated. Dry warm summers, which promote the growth of wheat and barley, parch the unshaded soil; and under such conditions the sun consumes the grass at a time when it is most needed for cattle. On land where heavy crops of corn are easily grown, and where there is a deficiency of moisture for the production of luxuriant grass, it would be unwise to attempt laying down any large area to permanent pasture. Thus, in the eastern corn-growing counties, the increase in permanent pasture is much less than in the western, or grazing, counties. Indeed, if one were to judge solely from some of the numerous letters received from eastern counties correspondents (communications not included in the following reports), it appears that the tendency in many districts is quite in the contrary direction. The soil and climate of the corn counties, so favourable to growing large crops of cereals, stimulate an increase of acreage under corn rather than under grass. Norfolk, for instance, is pre-eminently a corn-growing county, and Mr. C. S. Read, M.P., graphically illustrates the chances of any great alteration in the area of pastures taking place there by saying, "it is not likely much arable land will be turned into permanent pasture, unless something dreadful happens to the

price of barley!" (p. 489). Mr. J. Algernon Clarke also informs me that on the strong deep soils of Lincolnshire there is a tendency to increase the area of arable land by the popular introduction of steam-cultivation, enabling farmers to break up by steam-power stubborn poor soils, difficult to manage otherwise, and thus bring them under the influence of the plough. From Essex and Kent, again, the majority of the replies received to my inquiries state that no diminution of the area under corn is taking place, but that many persons are breaking up their poor pastures and converting them into arable land.

On light, dry, shallow soils, and on poor stiff clays, permanent pasture is with difficulty made or maintained, especially where there is not an abundant rainfall. This accounts for more than one correspondent making what, to most persons, will appear exaggerated statements of the labour and expense of laying down permanent pasture. Thus, Mr. Purvis says, "it will take a life-time to make good old pasture of old arable land," and Mr. Christy, that "a good pasture until after many years is the exception in this district" (p. 488). A moist climate is indispensable for a good and rapid growth of grass. Where the rainfall is above the average, pastures are more profitable, and improve more rapidly, even on soils of inferior quality, than they do on richer soils with a rainfall considerably under the average. Thus pastures on poor soils in Wales and the West of England will improve under treatment that would be quite insufficient to increase the fertility of grass-producing soils on the eastern coast of England. It is impossible to contend, except under great disadvantage, with the influences of climate. An average rainfall of upwards of 30 inches per annum appears to be necessary to secure favourable conditions for the growth of grass. Where the rainfall is less in amount than this, and the soil dry and poor, the judicious management of arable land will, I think, be found the most profitable course to pursue.

But although permanent pastures are not so readily made in the eastern counties as in the western and northern, large crops of artificial grasses are easily grown. On quick soils these get well established in the early spring; and afterwards, unless grazed bare, cover the soil, and retain its moisture sufficiently to keep up a continuous growth during summer. The artificial grasses do not require so much moisture as the natural species. There is, therefore, encouragement to extend the cultivation of artificial grasses, when an increased production of grass is desired, in the drier climate of the eastern corn-growing counties, these having, as a compensation, the capacity for growing good crops of artificial grasses. The enlarged area of sainfoin cultivated in the corn-growing counties is one feature of the present

movement. Its quick-growing, vigorous nature, and its spreading foliage, which shades the ground, and enables it to retain its moisture, and the better to withstand drought, are, no doubt, reasons for the increased popularity of this excellent plant. It is not surprising, therefore, to find that in this direction the eastern counties show a larger increase of artificial grasses over that which has taken place in the grazing counties, whilst in the latter the enlarged area of land laid down of recent years in permanent pasture is more marked.

For the purpose of this Report, an elaborate series of questions was arranged by the aid of the Secretary of the Society, and forwarded to gentlemen who, we were led to believe, had either laid down land to permanent pasture, extended the area of artificial grasses, or laboured at improving their already existing grass lands. Their replies we have, where necessary, thrown into the form of letters, using, as nearly as possible, the precise words of the writers. Although, however, the plan of putting a direct series of questions to our correspondents was found the best system of obtaining information, the conversion of their replies into readable consecutive sentences was a matter of some difficulty. The method adopted will account for the want of freedom and literary style in many of the reports. Whilst from some scores to whom we applied no answers of any kind were received, we have to thank for their prompt courtesy those gentlemen who have furnished us with the following interesting communications.

Reports from the North of England and North Wales. Collated by T. Bowstead.

1. Langton Field, Appleby, Westmoreland.

I hold my farm of 863 acres on lease, under Sir Henry Tufton, Bart. It is chiefly a light loam, with sandy subsoil, and is divided as follows :—arable, 617 acres; meadow, 15; permanent pasture, 196.

I have not as yet put down any land for grazing purposes; were I doing so I should take care to have it as dry as one requires it for tillage.

Weather permitting, I should sow my permanent seeds in the month of April, without a crop, and when fit I would pasture with mixed stock.

I consider that, by adopting a wider rotation of crops, I have increased the grass-producing area of my arable land to the extent of one-third; that is, by substituting a six-course (or sometimes even longer) for a five-course shift. This has diminished my horse-labour materially, and increased the stock of my farm by quite one-third. The land does, I find, become more foul under this practice; but a deep ploughing, though it may cost an additional 10*s*. per acre, cleans it effectually. My permanent pastures and meadows I enrich by eating roots upon them, and by the application of artificial manures and of lime. I am satisfied that by this means they carry a great deal more stock, but I do not here go into details.

R. Elliott, *Admiral.*

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2. Crossrigg Hall, Westmoreland.

I have in hand, of my own property, 488 acres; and of this I have sown down, since 1862, about 160 acres. This I have done partly through the rise in the price of labour: more because mixed husbandry suits our climate better than arable culture; but principally on account of the great permanent addition to the saleable value of land after it has become established as old grass. I selected, in the main, hilly situations, which, besides being difficult to till, must always while under the plough be subject to a serious loss of top soil. As a preparation for laying down I have taken a turnip crop, or, if time and opportunity allowed, two turnip crops in succession, which were eaten on the land by sheep. I have also worked from both stubble and lea; but in such cases the addition to labour in getting a fine tilth, and the necessity for buying more manures, add greatly to the expense.

I think land should be almost as thoroughly drained for grass as for tillage.

As to the time of seeding, I prefer the month of April, or as soon after as there is a good season; but rather than not have the land thoroughly prepared, I have waited through June. I sow all the seeds at once, and roll well. I recommend a little rape, in preference to a grain-crop, to be sown with the seeds. To lay down to grass land which has long been arable is an expensive undertaking, if it is to be done with success. The land must be put in heart, and, as the rest of the farm requires all the farmyard-manure made upon it, a ton of crushed bones per acre, with some good artificial manure, should be harrowed in at the time of sowing. I find that to mow the grass at all before it has made a "sole" is disastrous. Depasture with sheep in spring, and with bullocks and horses as soon as the seeds grow up to stalk.

With our moist climate, light land is very convenient to plough, whereas the stoppage of winter work on heavy land is often a serious matter. On this account I would give preference to having the latter as pasture. Poverty is, in my opinion, the only obstacle to laying down any description of land to grass, provided it be either naturally dry or fairly drained. A constant and abundant supply of water to stock of all kinds is very important.

Upon the arable portion of my farm I get less pasturage than formerly, because I have altered my five-course rotation into one of four, giving one year's grass instead of two. This circumstance has naturally increased my "acreable" outgoings for horse and manual labour, but this is more than counterbalanced by that saved on the rest of the farm.

With regard to the ancient grass-land, I have tried all possible means of improving it, but it seems like striving against poverty, though I believe it will ultimately repay me for the present heavy outlay.

In conclusion, I believe that arable land, highly farmed, carries and fattens more stock than the same quality of land kept in good grass.

Hugh Rigg, *Lieut.-Colonel.*

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3. Sedgwick, near Kendal, Westmoreland.

The home farm which we have in hand is about 437 acres. The soil is sharp and stony, and moderately rich, with surface undulating; some parts have the subsoil open and gravelly, others close and hard—a compound of puddled clay and gravel. Since 1867 we have put down to grass 128 acres, partly on account of the increased cost and scarcity of agricultural labourers, but more because of the proximity of that portion of the farm to Mr. Wakefield's residence. We tried two different modes of preparing the land. In the first of these we took a crop of oats; second year, swedes, partly eaten on the ground by sheep; third year, barley and seeds. The other method was—first

year, oats; second year, rape, consumed by sheep. Third year, the land being clean from all sorts of weeds, we ran a two-horse grubber through it and then across it, thus stirring it nicely without burying the sheep-droppings or uprooting the rape-stocks which were still alive; we then sowed our permanent mixture, and got a splendid crop of both rape and seeds, which fed off 9 sheep to the acre during the summer. The latter method I consider decidedly the better. The seeds included Pacey's and Devonshire evergreen rye-grasses, cocksfoot, three or four of the fescues, rib-grass, Timothy, cow-grass, alsike, white and Welsh red clovers, mixed and sown together, the proportions varying according to the soil and situation under treatment. In other instances where we have put down to grass we have applied with advantage 5 cwts. of raw bone-meal, 1 cwt. Peruvian guano, and 1 cwt. phosphates per acre; we then gave one stroke with the chain-harrow, sowed, and rolled the seeds. This dressing lasts very well on this land for five years, when we repeat the dose. We always depasture young seeds with sheep the first year, not eating them too bare at the end of the season; afterwards we can safely add a few cattle.

A continued outlay in grubbing out old fences, putting up and planting new ones, &c., charged to farm account, prevent so far a fair comparison between our present and former systems, but I find that the quantity of animals kept has, since we increased the pasture, been nearly doubled. I should recommend farmers to lay down the colder, close-bottomed land, and keep under the plough the warmer, free turnip soils.

With regard to the improvement of old pasture lands, we have not, except on the meadow land, applied any farmyard-dung, but I have, and with very good results, put a dressing of 5 cwt. per acre of bone-meal on about 80 acres. These 80 acres now carry 50 per cent. more stock than before, and that stock does 50 per cent. better.

Our practice on meadow land is to mow regularly once a year, manuring for each crop with farmyard-dung and artificials alternately. I cannot speak as to the extent to which grass land need be drained, because this farm, except in a few spots, is naturally dry.

Alexander Fulton,
Estate Agent to W. H. Wakefield, Esq.

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4. Hackthorpe Hall, Westmoreland.

I rent my farm of 350 acres under the Earl of Lonsdale. I hold it from year to year, and have no tenant-right; nor do I desire any, as I am of opinion that a good farmer makes a good landlord.

The soil is a strong loam, resting upon limestone.

In 1866 I laid down 20 acres to permanent grass, and in 1872 another field of 20 acres, which will remain as pasture if I find it continue to graze well; but I am doubtful about this, as it was previously so hard ploughed.

I was induced, by the increased and still increasing cost of labour, and by the enhanced value of live-stock, to have more of my farm under grass: moreover, I consider our climate (we are 800 feet above the sea-level), and the aspect of my farm, more suitable for growing live-stock than grain.

Land intended for permanent pasture is best prepared by growing a crop of roots with farmyard-manure, and raw and dissolved bones; the roots should be pulled off, and followed by a grain-crop, barley preferred. Strong land which has been frequently ploughed, if intended for grass, must be ploughed deeper, or subsoiled, as it is impossible to make land graze where there is a hard pan a few inches below the surface. This pan must be broken, so as to allow the water

to get away, and the roots of the grass to get down, otherwise they will penetrate so far and no farther, and then all the top-dressing in the world will be of no use; the plants, with the exception, perhaps, of a few shallow-rooted ones, which are not worth keeping alone, will sicken and eventually die.

I have tried sowing down with rape, but do not like this plan. The best way is to sow with a corn-crop, and then top-dress the seeds with the proceeds thereof. I like to sow the grass-seeds in April, light and heavy together, with the broadcast drill, half one way, and the rest across them. I can strongly recommend the following mixture:—

4 lbs. Cowgrass.	2 lbs. Sheep's Fescue.
3 " White Clover.	2 " Meadow do.
2 " Red do.	2 " Smooth-stalked Meadow-grass.
2 " Trefoil.	1½ bush. Italian Rye-grass.
3 " Timothy.	1½ " Perennial do.
3 " Cocksfoot.	

As regards the treatment of young seeds, I would apply in the autumn 8 to 10 tons of farmyard-manure per acre: then in April, or early in May, top-dress with ¾ cwt. nitrate of soda, 3 cwt. kainit, and 2 cwt. bone-superphosphate. By all means mow the first year, as by letting the clover and grasses grow a good height the roots get a proportionate hold of the ground; after this depasture with sheep, but do not eat too bare. Land recently laid down requires most attention during the third and fourth years, as the artificial grasses are then giving way, and those indigenous to the soil have not got established. At this time, if the land does not graze equally, I would mow, and return to the land an equivalent in manure—farmyard if it can be spared. By this means you obtain a more close and even sward than by any other method. No doubt the land here is better adapted for grass than for ploughing; but if all were laid down we should be short of winter-keep, and be forced to market with our stock in the autumn no matter how bad the prices. A breeding-farm should carry about the same number of stock in winter as in summer, so as to enable the farmer to take advantage of good markets, or to hold on if they are bad.

Strong land, taking the year round, will produce the most grass; therefore I should select such for laying down, especially as lighter soils will throw equally good crops of both corn and roots, with one-third less labour. Strong land, in this rainy climate, cannot be too well drained either for corn-growing or grazing; more especially the latter, as the drier the land is the sooner the snow disappears, and the earlier in the spring does the grass begin to grow; and not only so, but, owing to the increased temperature of the soil, the bite is sweeter, and consequently more fattening.

As regards grasses under rotation, I now let these lie as long as they seem disposed to graze well, and, in view of this, I have added cocksfoot, fescues, and Timothy, to my mixture of seeds, and substituted cow-grass for red clover: and I find that strong land in good heart cleans itself by lying green side up.

I have done a good deal to my pastures in the way of applying bones (half-inch bones fermented, or made more readily soluble by liquid manure from the tanks), and by eating corn and cake upon them by sheep.

I use portable manures chiefly for the turnip-crops, as I consider they are of more benefit when buried than when sown on the surface, and I put the farmyard-manure on the grass lands.

JAMES C. BOWSTEAD.

5. Howgill Castle, Westmoreland.

I rent, on a nineteen years' lease, a farm of 900 acres, belonging to Sir Henry Tufton, Bart. I have no tenant-right. I have both light and heavy soil, of fair average quality, with generally a pretty strong subsoil.

In 1857, partly through the increased value of stock and difficulty in procuring labour, but chiefly on account of the high situation of my farm, its contiguity to the Crossfell range of mountains, and exposure to freqnent "helm-winds," I commenced laying down pasture. At that time the farm was made up thus:—350 acres arable, 50 acres wood-land and river-banks, and 500 sheep-walk.

My experience has been chiefly in the breaking up and relaying old grass-land, and I proceeded as follows:—Having ploughed up the turf, I took two successive white crops, then turnips, followed by a white crop, with permanent seeds. Practice, however, has taught me that in dealing with certain stiff, benty portions of my sheep-walk it would have been better to have dispensed with the last white crop, and to have sown the grass and clover-seeds alone. In fact I am now, from experience, so partial to this course, that, with the consent of my landlord, I am inclined to take two successive white crops on all the land I have in cultivation, and sow down without a white crop; and in that case I would manure the second white crop with farmyard-dung, apply artificial dressing to the turnips, and then sow down alone, or with two or three pounds of rape-seed. I sow at the end of May, light and heavy seeds being mixed together. In addition to Italian and perennial rye-grass, I use meadow-fescue, foxtail, cocksfoot, rib-grass, and the best varieties of clover. I do not approve of mowing young seeds, bnt would pasture chiefly with sheep, turning on in dry weather a few cattle or horses, to prevent the rye-grass running to seed. I can now keep upon my farm double the number of cattle and one-third more sheep than formerly: but this is chiefly owing to its general improvement, and not to the extra quantity of pasture. I would keep the strong and naturally wet (although drained), high-lying land in grass, and retain what is generally known as turnip and barley-soil under cultivation. My landlord has done a large amount of draining, upon the cost of which I pay the usual interest; but I am persuaded that it is not so indispensable to have grazing and meadow land so uniformly dry as that required for arable purposes.

With regard to arable land becoming foul, the best preventive is to keep it manurially rich.

I have used on some of my high pastures, after draining, nearly 10 tons per acre of good lime of my own burning: I also improve them by eating turnips upon them; or by running sheep over them at night, which are on turnips during the day. I venture to state that the most remunerative of all capital expended upon land is that which is laid out in improving it "green side up." I have known the keeping powers of land so dealt with nearly trebled.

James Mitchell.

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6. Shatton Hall, Cockermouth, Cumberland.

I am the tenant, from year to year, of 320 acres of land. The soil and subsoil are of a most variable character, two or three kinds occasionally occurring in the same field. I have no tenant-right beyond the custom prevalent in the district, by which, on leaving at Candlemas, I should be paid for seeds and wheat. In 1864, mainly through the high price of fat and lean stock, I determined to put down my best land to pasture, and have now treated about 90 acres in that way. It is undoubtedly very important to have the land clean and in high condition. I have sometimes laid down with a crop, and

sometimes without, taking care in the former case to give an extra dose of bones, guano, or other artificial manure, sowing the seeds about the end of April; or, if alone, at the end of July or August. I sow the light and heavy seeds separately. Timothy grass, I find, is much relished by all kinds of stock, and therefore my mixture includes, besides Italian and common rye-grass and the several kinds of clover, 1 stone of Timothy: the oat-grasses and such like will, I find, come abundantly of themselves. I may say that I prefer seeding down without a crop; but if the opposite plan be adopted, I would recommend that the seeds be slightly eaten immediately after harvest, and then top-dressed. I mow the first year, and for this reason: I consider the seeds make better and stronger roots, and sooner acquire that thick bottom which is so important. As to the profit arising from my altered mode of management, I am satisfied it is considerable, as about three times the number of stock is annually bred and fed off.

Draining can, I consider, for grazing purposes be carried to an excess; it is sufficient to check the growth of rushes and other coarse herbage.

I find that recently laid down grass, if properly manured from time to time, increases rather than diminishes in fertility as it acquires maturity.

DAVID RAPLEY.

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7. CROSSHILL, WIGTON, CUMBERLAND.

I occupy 245 acres of my own property. The major portion of the soil is good, and adapted for the growth of cereals generally, but more especially oats and barley; the subsoil is red sandstone and gravel or clay. The remainder is soil of fair quality, on good clay subsoil. The average rainfall is about 33 inches. A variety of circumstances, beginning with the year 1854, have induced me to lay my land down to permanent pasture; and more recently the increased cost of agricultural labour has acted as a further stimulus. I have generally pursued the following method of preparing, cleansing, and seeding down the land; that is, after ample preparation, I have taken a turnip crop, which I consumed on the ground by sheep, and in some instances a second turnip crop eaten on in like manner; then, after ploughing and well pulverising, I sowed down in April or May with a liberal quantity of seeds—which I varied according to the nature of the soil—in addition to 4 lbs. of rape, or a little barley, to be eaten green. I applied a liberal dressing of seeds, which I varied according to the nature of the soil. The best after-treatment for young seeds, or old grass land, is a covering of well-rotted farmyard-manure, spread on in the autumn; but I have occasionally observed stock dislike for a time the herbage so produced. I would depasture rather than mow, and with sheep in preference to cattle, taking care never to punish the pasture by eating too bare for a season or two.

I do find considerable increase in the number of animals kept, especially in summer; under the circumstances little winter forage is provided, with the exception that the farm carries more stock in summer than in winter. My impression is that the best descriptions of soil pay most in grass, while poorer land is more suitable for tillage.

Some situations require more complete draining for arable than for grazing purposes.

PATTINSON HAYTON.

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8. MUSGRAVE HALL, SKELTON, CUMBERLAND.

In addition to my own estate of 320 acres, I occupy 70 more upon lease. It is principally a deep strong soil on limestone, sandstone, and clay. Our average rainfall is 38 inches, and the situation is somewhat high and exposed.

Principally on account of the increased value of stock, but partly also on account of the advanced price of labour, I have laid down upwards of 70 acres. I selected land which had a good water supply, and which I considered capable of fattening cattle and sheep. I have tried different modes of preparing the land, but what I have sown down with rape and seeds in July—the previous year's crop having been corn out of lea—has answered the best.

The crop should on no account be eaten bare the first year, or many of the young grasses will be destroyed.

I approve of manuring the young seeds in the autumn, and grazing the following year with young cattle. At the end of the second or third year, I have generally given in the month of February from 6 to 8 cwt. per acre of crushed bones. Without going into details, I am satisfied the increasing my pasturage has been a judicious step. I have now something like three times the quantity of stock that my farm formerly carried; for instance, where twenty years since I fed something like 70 sheep during the year, I have now (June 1874) already sold 200 fat hoggs, and have still remaining 150 ewes with over 200 lambs, besides something like 90 head of cattle. The greatest improvement I have made on my farm is with respect to what was formerly a coarse, wet, rough pasture of 95 acres, which grew a kind of herbage that nothing would eat. This I thoroughly drained, and dressed with half a ton of dissolved bones to the acre—I like the month of February the best for applying bones to grass-land if the weather is mild and seasonable—(lime I tried without effect). This pasture carries fully three times the amount of stock it used to do, besides improving them to a much greater degree. The climate of this neighbourhood being moist, and the soil generally retentive, the land cannot be made too dry either for grass or tillage. With regard to my arable land, I have reduced my rotation from a five- to a four-course shift, and in this way I am able, with extra manuring, to produce the same bulk of straw crop as before, with considerably less land under rotation of cropping.

Some twenty years ago the following quantity of stock kept on the land I now occupy will be pretty near the mark:—40 to 45 head of cattle, and about 70 sheep—at the present time 90 to 100 head of cattle, and from 350 to 400 sheep—besides an increase in horses in comparison, and fully as much bulk in crop.

J. C. Toppin.

9. Preston Hows, Whitehaven, Cumberland.

This farm, which I rent from year to year, under the Earl of Lonsdale, without a tenant-right, comprises an area of 400 acres. The soil and subsoil are extremely various, one part being stiff clay on a clay subsoil; another, good loam on the magnesian limestone; and some, light soil on red sandstone.

In 1846, mainly on account of the then predatory habits of our mining population (several of my fields having footpaths over them), I determined to increase my quantity of pasture land, which even then extended to 125 acres; and since that time I have laid down about 60 acres.

At first I prepared the land by a bare fallow or green crop, sowing down the following spring with rape and seeds. This plan, however, not answering to my satisfaction, I have since adopted, and much prefer, the plan of taking a crop of *wheat* after the fallow or roots, and then (weather permitting), sowing the grass-seeds about the end of April, first harrowing the wheat three or four times over in order to secure a proper seed-bed. I sow the seeds (light and heavy) at one operation, and the best dressing I have met with is the one commonly known in the North of England as "Jefferson's mixture;" this is composed as follows:—

6 lbs. Italian Rye-grass.	2 lbs. Meadow Foxtail.
6 „ Perennial do.	1 „ Crested Dogstail.
3 „ Cocksfoot do.	1 „ Ribgrass.
2 „ Timothy do.	5 „ Alsike Clover.
3 „ Meadow Fescue.	5 „ White do.
1 „ Various-leaved do.	3 „ Cowgrass.
2 „ Rough-stalked Meadow-grass.	

Total = 40 lbs. per acre.

The young grasses should, I consider, be allowed to flower and seed before being depastured, and therefore I prefer to *mow* during the first season or two.

In selecting land for permanent pasture, or meadow, I would certainly put down the stiff clays, and keep in tillage those which can be easily worked for green crops. I am fully satisfied that the additions I have made to my pasture and meadow land "pay" me, but I have not gone into minute calculations. I have never known naturally wet land *over-drained* for grazing purposes.

With regard to the still arable portion of my farm, I have also upon this increased the grass-producing area. Instead of ploughing out the clover-root, as was my custom when I entered upon the farm, I now leave it "green side up" for two, three, or even four years, according as it may be grazing to my satisfaction. My former course was oats, roots, wheat, seeds; and, to insure a better set of grass for the longer period, I now add to the usual mixture for alternate husbandry a few pounds of the earliest and best permanent grasses. My land does not become foul under this extended rotation any more than when I practised the four-course shift.

As to the improvement of well-established grass, I consider this can be best effected by the consuming upon it at all possible seasons oil-cake and other feeding stuffs. Such, at any rate, is my practice, and I am in this way enabled *profitably* to keep a larger head of both cattle and sheep.

Robert Jefferson.

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10. Escrick, near York.

My experience in the formation of permanent pasture has been chiefly upon stiff clay land, such as would not grow with profit either mangolds or turnips. The light soils here will not grow good grass; moreover, they will carry more stock when kept under cultivation. Our plan has been to clean the land effectually by means of a thorough fallowing, then to plant wheat or barley, very thin, and sow the grass-seeds broadcast, in April, covering them with the brush-harrow. We have not tried sowing without a crop. In a climate so dry as ours (our rainfall averaging only about 26 inches), we consider that the grain crop is invaluable as a shade to the young seeds. With a more humid atmosphere I should be inclined to sow down with rape.

After harvest, if the surface of the seed-field be spongy, it is desirable to use a heavy roller freely. Much of the failure of clover is due to mechanical condition. No stock should be allowed on unless the seeds be very big, and then only light mouths, as lambs and calves, should be run over. If a light coat of foldyard-manure can be spared, the same may be applied in winter and carefully spread; but as the lumps of manure are often injurious to the delicate seeds, I prefer an artificial dressing, such as soluble phosphate, potash, and ammoniacal salts, applied in spring. The question of mowing or pasturing would depend upon the nature of the soil; on light land I would certainly graze with young cattle, but on strong soils mowing encourages root growth. Where the plant is thin it may with advantage be allowed partially to seed. Old sheep are

not desirable at this early stage. In the generality of cases there is a visible diminution in the produce after the second or third year, and it is at this critical time that a good dressing of well-made dung will tell its tale.

With regard to the grazing derived from our arable land, we have in this locality found decided advantage from allowing the seeds to remain down two or even three years instead of one. Also upon light land the plan of top-dressing the clover with artificials has been found to increase the crop both of hay and aftermath to such an extent as to well repay the outlay. Formerly, on our light-land farms, a four- or five-course system was followed, but now we frequently take two white straw crops in succession. Probably the most common rotation on sandy soils is as follows:—

1. Turnips, grown with a light dressing of dung and artificials.
2. Barley and seeds.
3. Seeds, mown or fed.
4. Seeds, fed.
5. Potatoes, heavily manured.
6. Wheat or barley.
7. Oats, with artificial manures.

If the seeds are kept down only one year the above simply becomes a six-course shift. Undoubtedly this extended rotation has a tendency to make our land a little more foul; but upon strong land we have adopted a plan of making a bastard fallow, by breaking up the seeds in July, for wheat. This answers very well, and, with ordinary weather and proper attention, ensures cleanliness.

The improvement of our already existing old grass land has long been considered of the highest importance in this locality. The first step is drainage, if the presence of water-grasses indicates stagnant water; not otherwise, for I do not believe that grass land needs to be so uniformly dry as arable ground. Secondly, we adopt a dressing with artificial manures, a very favourite mixture being 3 cwts. bone phosphate, 1 cwt. kainit, ½ cwt. of nitrate of soda, or a compound of the last-named with sulphate of ammonia. This, costing from 30s. to 33s. per acre, has been applied towards the end of March, and continued for several years with marvellous effect; for, in my opinion, where grass land has become thoroughly impoverished, the top-dressings must be repeated at least five or six years in succession before any permanent condition can be looked for. Thirdly, we enrich our grass land by consuming upon it, at all convenient seasons, cake and corn, pulped roots and chaff. Need I say that each and all of these modes of treatment have had a most marked effect? I can point to land which was formerly so wretchedly poor, and wet, and starved, that, to use a common expression, it would have "rotted a goose;" where carnation-grass usurped the place of everything, and presented, with unsightly rushes, a truly poverty-stricken appearance, but which, through the treatment above described, has been converted into excellent breeding-land, full of white clover, on which young animals grow and do well, and where, during the height of summer, Irish heifers can even be fattened with the aid of cake.

In laying down land to grass, it is the custom in some parts of Yorkshire for the landlord to provide seeds and manure, charging 5 per cent. on the outlay, and of course claiming such land as grass ever afterwards. I think a better plan is for the tenant to do the work himself, as the land then remains as arable in the schedule of his agreement, and he can either plough the ground out again or leave it to be taken at a valuation by his successor as pasture-land.

I may observe that on this estate, and throughout the country, the holdings are generally from year to year. A tenant-right is attached to Lord Wenlock's agreements, providing a scale of compensation for outlay in draining,

carting material, marling, or liming. It also secures to the tenant a return of half the cost of cake used in the last year of the term, and half the value of artificial manures applied upon grass land in the last year, provided such land be not mown.

JOHN COLEMAN, *Agent.*

Riccall Hall, York.

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11. BAINESSE, CATTERICK, YORKSHIRE.

My farm extends to 500 acres, and in 1844 consisted of 380 acres of arable land, 20 acres of meadow, and 100 of permanent pasture. About half the farm is a gravelly and the rest a strong soil. The high price of stock and increased cost of labour have induced me to lay down about 130 acres, chiefly without a crop of corn; this I have done at an average expense of 10*l.* per acre, not including the cost of seeds, which have been provided by my landlord.

Having well cleaned the land in early summer, my plan has been to sow the seeds about the middle of July, applying at the same time 15 cwt. of bones per acre. The following was my mixture of seeds for a 12-acre field:—

36 lbs.	Meadow-grass.	50 lbs.	White Clover.
36 „	Evergreen Rye-grass.	24 „	Alsike.
60 „	Fescue.	24 „	Cowgrass.
50 „	Cocksfoot.	12 „	Red Clover.
60 „	Pacey's Rye-grass.	12 „	Timothy.
50 „	Italian do.		

I keep the seeds free from stock the first year, and afterwards depasture with cattle and sheep.

I find that grazing pays better than ploughing, both on heavy and light soils; I can keep double the quantity of stock; and the produce of the recently laid-down pasture increases as it acquires maturity. I have been able to diminish my horse and manual labour about one-third.

With a view to the improvement of my permanent pasture, I have consumed large quantities of cake, and part of the root-crop on it; eating the remainder of the roots with cake, &c., where they grow, to avoid impoverishing the tillage-land, part of the farmyard-manure being applied to the grass land, of which I mow from 20 to 30 acres once every year.

JOHN OUTHWAITE.

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12. HALTON CASTLE FARM, NEAR CORBRIDGE, NORTHUMBERLAND.

This farm, the total extent of which is a little over 530 acres, is occupied by the owner, Sir Edward Blackett, Bart. The management is under my direction. The soil is loam, of fair average depth. In 1865, owing partly to the remunerative prices obtainable for stock, but principally to the increased and increasing cost of labour, and with a view to letting the lands annually as grass-parks, by auction, it was decided to extend the quantity of pasture land, and since that date I have put down about 222 acres, the whole having produced most satisfactory results.

I began the process in every field by draining thoroughly such parts of the land as required it, and then covering the oat-stubbles in autumn with clod-lime, at the rate of 12 tons per acre, and ploughing it in immediately. In the following spring the land was properly cleaned and sown with turnips, manured as follows:—15 to 18 cartloads of rotten dung, 10 bushels of undissolved bones, 2 cwt. of Peruvian guano, and 3 cwt. of superphosphate, per acre.

The turnips were drawn off in strips, one-half being eaten on the land by sheep, and the other half carted home for the cattle.

As soon as the land was dry enough in spring, it was ploughed very lightly, and worked down to as fine a tilth as possible, and the seeds were sown at the end of April or beginning of May without a corn-crop. Immediately after sowing I had the land heavily rolled. "Sutton's mixture of grasses for a loam of medium texture," costing 32*s.* per acre, has answered my purpose well.

As to the subsequent treatment of young seeds, the land having been in this case laid down in good heart I have not found that any assistance was needed for five or six years; but after this period I have usually folded sheep on the land in summer, allowing them to consume half-a-ton per acre of linseed-cake: the sheep had liberty over the whole field during the day, and were folded all night, and fed with the cake. I allowed the young seeds to be pastured with sheep only during the first season, but after that cattle also have been permitted. I prefer that the seeds should not be mown.

This altered mode of farming has, I am satisfied, paid the owner well.

Previous to Halton Castle Farm being taken in hand, in 1865, the lands now laid down would not let for more than an average of 23*s.* or 23*s.* 6*d.* per acre. In 1874 the summer eatage alone on these same fields, when let at auction, brought, after making a fair deduction for tithes, rates, and cost of shepherding, an average of fully 50*s.* per acre. I grant that portions were taken for accommodation purposes, and therefore the comparison was hardly a fair one; but I should say that if let to farm in the ordinary way these fields would fetch from 37*s.* to 40*s.* per acre.

As a general rule, in Northumberland, I have not found it desirable to lay land down permanently that will fairly grow turnips, or on strong clay soils where, with good cultivation, four quarters of wheat per acre can be grown after a bare fallow. The latter may with advantage be allowed to lie three years in grass before being again ploughed up, thereby reducing the cost of labour. I consider that land intended for permanent pasture should, in all cases where requisite, be in the first outset thoroughly drained and well manured.

THOMAS SAMPLE,
Agent to Sir Edward Blackett, Bart.

13. MILFIELD, WOOLER, NORTHUMBERLAND.

My farming operations are spread over many holdings extending to several hundred acres. A portion of the land is my own property, the rest I hold under lease, without tenant-right. I have every description of soil, from stiff clay to fine loam and gravel.

In 1872 our rainfall reached 48·5 inches, but the average I take to be about 24 inches.

As far back as the year 1833 I turned my attention to the laying down of permanent pasture, of which I have now done many hundred acres. I found stock-breeding and feeding pay better than corn-growing, although labour was not then so expensive as at present.

Clay-lands are naturally expensive under tillage, but even fine friable soils have paid me better in grass than corn. My land has generally been rich and fit to lay down; but, where not so, I have taken two successive turnip crops, and eaten them on the land with sheep.

I selected a mixture of seeds suitable to the soil and situation. I prefer sowing with a crop of corn. I have not practised inoculation, but from what I have seen of it I prefer the commoner method of sowing.

I do not mow; if I did, I should cut very early, before any stems harden

or run to seed. Newly-laid land should not be eaten very bare with sheep, lest they nip out the fine clovers, which, in a droughty season, may not come again. My experience is that much more stock can be kept during the first two years on newly-laid down land than subsequently; it is then apt to fall off, and may not do well for six or eight years, perhaps never. There is often a loss between the third and tenth years which few tenant-farmers can stand.

I have received no aid from my landlord, but whether acting in that capacity, or as agent, I generally provide the seeds, if the land is in proper condition. I have also given manure for top-dressing, the third or fourth year, to the value of 20*s.* to 40*s.* per acre. I prefer sowing down good turnip-soil, because it takes better and continues to improve, whereas clay-land generally goes back after a few years. On the still arable portion of my farm I let the artificial grasses lie for two or three years, or as long as they remain good; this is the only way in which my rotation of cropping is altered, and I consider it the best form of arable farming.

Intending to let seeds lie for three or more years, I should sow little or no red annual clover, but more alsike; and if for sheep-pastures on light soil, more trefoil; if for cattle, more cocksfoot.

I have not found land become more foul through lying longer in grass. I have lately taken up several fields, say 147 acres, which had laid from twelve to fifteen years, and I have not seen a barrowful of couch on the whole! If I had land in such a state I should take two successive turnip-crops, or turnips, barley, then turnips again, taking care to eat all the turnips on, and there would not be a bit of couch upon the land afterwards.

The best application for permanent grass is farmyard-manure, and, where needed, seeds sown and brushed in in the spring. I never saw any good from bones on the surface. Guano or nitrate tells at first, but does not last. Consuming cake, &c., by sheep or cattle does good, but is uncertain and unequal, some parts being much improved, others in a less degree. I mow about 30 acres annually of old meadow. As to the benefit derived from enriching grass land I can give no statement in figures; but when I see improved pastures keeping double the quantity of stock, and keeping it well, I conclude it pays.

G. A. Grey.

14. Carham Hall, Coldstream.

I have laid down three fields to permanent grass by the process known as "inoculation." The first contained 21 acres, and was put down in two portions, in successive years, about fifteen years ago; the second, containing about 18 acres, five years ago; the third in 1873, comprising some 6 or 7 acres. All have succeeded very well, and are improving annually. Fifteen years before my adoption of this plan, I laid down the 21 acres with the best grass-seeds I could procure, along with a thin crop of wheat; and for three or four years the pasture looked well, but subsequently it deteriorated year after year, until at length I got out of temper with it, tore up first one half and then the other, put them through a course of husbandry, and then sowed a thin crop of wheat and barley respectively. In April, or early in May, when the corn was a couple of inches above ground, I inoculated in the following manner:—I turned up the "sock" of a plough, and combed from an old pasture-field strips of turf 4 inches wide, leaving each time an interval of 4 inches, until I had got sufficient. I then carted the turves, so provided, to the land under experiment, where men with spades cut them across in lengths of 4 inches, making each piece of turf 4 inches square. A sufficient number of women and children then filled their swills with them, and carried them off to the ends of the drills, and having dug out little holes with a short

hoe 1 foot apart each way (a couple of corn-drills being left between), put a turf into each as they went, stamped it in with their foot, and so on until their swills were empty and they returned for more. Thus the whole field was inoculated with turves 4 inches square, at a foot apart, so that 1 acre of land, if entirely pared, or 2 acres, if half only of the turf were taken up (as in my case), served 9 acres of land to be laid down. The *thickness* of the turves, I may state, would vary from 2½ to 3 inches, according to the growth of the *roots*, the object being to remove the *whole* of the latter. I then sowed a light covering of white clover seeds, rolled the whole, and the operation was finished, at a cost, exclusive of my own horses and drivers, of 1*l.* per acre. Nothing further was now required except constant herding to prevent the rooks disturbing the turves when in search of grub. For lack of this on one occasion, through the absence of my woman-herd at a two hours' church service, the rooks turned over nine-tenths of the turves on 10 acres of ground, and the whole had to be replaced, and rolled again; but otherwise no harm was done. The hoeing is simply to prevent the turves from standing above the rest of the surface. In course of time they are trodden in, but unless their bed be slightly scooped out they remain visible for several years.

The fields I selected for the supply of turf in each of the three cases quoted were very old pasture, and, the roots being thickly matted, they were well fitted for the purpose in view. The high ridges and deep furrows are evidence that they have been ploughed at some time, but this can scarcely have been within the last 200 years. The effacement of the gutters or wrinkles made by the sock of the plough I simply left to nature and to the treading by the hoofs of stock. The roots make rapid growth at the sides of the ruts, and, so far from the herbage being *diminished*, I believe more food is obtained after than before the operation; the grass grows at the sides as well as upon the top of the intervening strips, and, unless the ground be eaten very bare, the abstraction of the alternate rows is scarcely visible even where taken only two or three years ago. In the first year I tried the plan, May and June were exceptionally dry months, and corn and grass-turves alike were as brown as the adjoining turnpike. The neighbouring farmers, as they rode to Kelso market, ridiculed the experiment; but nevertheless, in the following summer, very few bare spots remained, and meanwhile a good crop of wheat was reaped, and the autumn growth of grass afforded a fair bite for sheep.

The 18-acre field mentioned, being close to one of my homesteads, was laid down purposely for cow-pasture; the tenant, on renewal of his lease, willingly accepted it as permanent grass, and took a crop of hay from it the first year after inoculation. In conclusion, where I could have access to really good old sward suited to the purpose, I would never lay down land to grass in any other method than the one described.

R. Hodgson Huntley.

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15. Wheelbirks-on-Tyne, Northumberland.

This farm of 133 acres I purchased in 1864, and in 1866 I took it into my own occupation. About one-half is strong clay-land, while one-fourth is moss, and the remainder gravel. Our rainfall fluctuates vastly, the average from 1856 to 1873 having been 29·21 inches per annum. In 1871, however, a neighbour's gauge collected 33 inches, while in 1872 the enormous quantity of 52 inches was registered.*

* It may here be noted that this quantity of 52 inches (though little more than a third of the rainfall reported in 1873 from certain of the lake and mountainous districts of Cumberland) represents 1,176,371 imperial gallons, or 5251 tons 13 cwts. 20 lbs. to each English acre.—T. Bowstead.

Wages having an upward tendency, and grazing being more to my taste than corn-growing, I have put down in pasture about 36 acres, taking care always to select the stiffer portions of the farm. My method of preparing the land was as follows:—Where requisite, I drained with pipe-tiles, 4 feet deep and 18 feet apart, being particular to convey the water into large stone troughs. I then applied a liberal dressing of lime, and ploughed it deeply in during autumn. In spring I gave another ploughing, as well as scarifying, harrowing, &c., until the land was thoroughly cleaned, and then sowed turnips, which I dressed with farmyard-manure and 10 cwts. per acre of ½-inch bones. The roots, being a heavy crop, were partly drawn off; the rest were consumed, where grown, by cake-eating sheep, and the barley or wheat, as the case might be, sown in March or April, according to weather. I used a mixture of permanent seeds, supplied by Messrs. Carter, and, to insure equal distribution over the land, I sowed one-half in one direction and the remainder the reverse way.

My after-treatment of the young seeds has been generally this: I have in the first spring top-dressed with a mixture of dissolved bones and guano, and occasionally mown *twice*. In the second year I mowed once and then depastured with young cattle and sheep, having also one feed per day of linseed-cake and cotton-cake, in equal parts. In the third season I have altogether depastured, spreading turnips on the land or giving the sheep a run on an adjoining turnip-field, as soon as the crop was ready in autumn.

My altered system of management saves me the cost of one man and one horse, while at the same time it has enabled me to increase my cattle by 15, and my flock of sheep by 36 head.

With regard to the old grass land which I found on entering the farm, I have had the whole of it drained with 2-inch pipes, 4 feet deep and 18 feet apart, emptying into mains of 4½ feet deep, and provided with 3, or, where the run was considerable, 4-inch tiles, the water being carefully collected in troughs for the use of the stock. I then covered the entire 55 acres with well-burnt lime; and in spring, when this was out of sight, I applied from 12 to 15 cwts. per acre of ½-inch bones, along with a dressing of Carter's renovating grass-mixture. In the autumn I put on purchased farmyard-dung, and the following season I was rewarded by a splendid crop of hay. Of these 55 acres I now mow one-fourth each year, the remaining three-fourths being depastured in the ordinary way; and I prefer this to mowing the same plot year after year. What was when I entered into possession one continuous bed of whins, broom, wild roses, and heather, I have by the above treatment converted into beautiful green pasture; and it need not, therefore, be wondered at that in ten years my head of stock has, as shown below, mightily increased:—

Stock kept in 1864.	*Stock kept in* 1874.
10 Sheep.	114 Sheep.
3 Cows.	4 Cows.
7 Young Cattle.	25 Young Cattle.
	4 Young Horses.

And these figures, I would remark, are taken quite distinct from the stock maintained, as already described, upon my recently-formed grass land.

George Thompson Dickinson.

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16. Preston, Wellington, Shropshire.

Besides 12 acres of my own land, I rent a farm of 87 acres, from year to year, with no tenant-right. The soil is sand, gravel, peat, and clay: the rainfall does not average more than 25 inches. In 1854 I had 66 acres of

arable land, and 33 of pasture: since that time I have laid the whole of the farm down in grass, having been induced to do so on account of the increased cost and difficulty of obtaining labour on a small farm. As regards draining of grass land, I do not consider it need be carried out to the same extent as for land under the plough.

I have always prepared the land by growing a crop of turnips, and then sowing the grass-seeds, light and heavy together, in April, with a crop of barley or oats, sown thin, and allowed to ripen. The mixture of grass-seeds I have not found of so much importance as a high condition of land. I always endeavour to get the land into good heart before laying it down, and then I find it profitable to dose it well annually for the first four or five years; which treatment compels nature, as it were, to produce grasses which are indigenous to the soil. In this, I consider, consists the secret of the whole business. I should prefer depasturing the young seeds with cattle, but should be guided, in a great measure, by seasons. In a moist season I should prefer to depasture with sheep, or even to mow: but, if mown, a very liberal dressing of manure will be required. I deem it of the utmost importance to avoid, as much as possible, treading and poaching the seeds for the first two or three years. Since I have laid my land all down to grass I have been able to keep two-thirds more cattle, chiefly for fattening. This year I have 80 beasts growing into heavy weights, and that with a light rainfall the first six months of 1875. I consider that clay-soils are best farmed as grass, while the light, friable land is more suitable for ploughing. As to the improvement of permanent pasture, I have found that best effected by heavy dressings of prepared bones and farmyard-manure; also by a liberal consumption upon it of linseed-cake, corn, and decorticated cotton-cake; and I may state that the land so treated has rendered a good return for the outlay.

H. Brown.

17. Skimblecott, Much Wenlock, Shropshire.

I am engaged, along with my father, in managing a stiff, wet, clay farm, of 367 acres, of which 200 acres are under the plough. My remarks, however, will apply to a large part of South Shropshire, on the western side of the river Severn, equally with our own immediate tenancy. Receiving, as we do, a large amount of moisture, which sweeps in a south-westerly direction from the Bristol Channel, our climate may be reckoned a damp one, and therefore more adapted for grass and green crops than for grain. The cold clays under cultivation in this and similar situations are sadly out of place, and have long ceased to be other than a source of annoyance and loss of time and capital to the occupier, especially with the present increased price of manual and horse-labour. Depend upon it, a stiff clay fallow, alike drained as undrained, is a subject requiring long credit, and, even with the utmost indulgence, seldom meeting full payments. The horses required to cultivate land of this description eat nearly everything it produces, except the wheat-crop; and this last will not yield more on an average of seven years than 18 imperial bushels per acre of saleable grain. These, and numerous other facts I could deduce, sufficiently explain the necessity of putting down to grass a large portion of the heaviest land in the Western and Midland Counties. But I would at the same time utter a note of warning against haste and precipitation in so doing; for nothing can justify the laying down land in an unprepared, rough-and-tumble state. We know that the great secret in forming good pasture consists in the being able to preserve the finer grasses and clovers, which almost invariably die out after the first three years. Freshly put-down

seeds should be treated in the same manner as a newly-born heir—as an object beaming with hope and promise, and one not to be left to shift for itself in careless neglect and poverty. It is in my opinion a wise plan to mow the first year, and then graze pretty hard with young cattle, of a description likely to pay for a few pounds of mixed cotton- and linseed-cake. Sheep should be by all means excluded for some years, as they destroy the crown of the clovers, and eat out all the best grasses, to the advantage of the coarser varieties. There is little doubt but that five pounds' worth per acre of a suitable mixture of phosphates, potash, and ammonia, would, at this stage, if only tenant-farmers could feel secure in their investments, be amply repaid in after years. In any case, new pastures must receive liberal dressings and careful management, and, if so treated, I fail to see why hundreds of acres of almost barren clays should not be turned to a profitable use, instead of being, as they are now, a heavy clog on the energy and capital of the unfortunate occupier. Of course I am not assuming that the whole of any farm should be laid down to grass, as some provision must be made for wintering stock: but I would urge the practicability of laying down all strong land, where water is available, except that portion which can be profitably farmed on a four-course system of turnips, barley, seeds, and oats. When this cannot be done, and it is urgently necessary to keep a part in an arable state, I would suggest the following plan as better than the old system of wheat-fallow, after which it is so difficult to get clover; plant the oat-stubble (supposing it to be drained) with winter-tares in September, or early in October, graze the following summer with sheep, plough down deep in October, work well in spring, and drill with barley and seeds. In doing this, wheat would form no part of our produce, which would at first appear novel and impracticable: but I feel sure, if we studied the simplest natural laws and local climatic influences with half the zeal with which we cherish old rickety practices, we should be better able to battle against seasons and other obstacles in our path. This altered system would largely increase the quantity of young cattle, which might be wintered in covered yards, saving a large portion of straw (now only used as litter) to be consumed as chaff, with a few pulped roots, and, if possible, a dash of corn or cake. The result would be a vastly-improved manure-heap, whereby heavier crops would be grown on a diminished area; and this I take to be the desired end and aim of all good farming.

James Wetherell.

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18. Chirbury, Shropshire.

The extent of my farm is 360 acres. I rent it from year to year, and have no tenant-right. The soil and subsoil vary from a stiff loam on clay to gravel on sand, and light brash on soft rock. Our rainfall is a medium one.

In 1867 my farm was made up of 153 acres of arable land, 153 permanent pasture, and 54 meadow: but since that time I have seeded down about 57 acres. In doing this I was mainly influenced by the increased cost of horse and manual labour, which, with seed and manure-bills, absorbed on this class of land the whole of the crop.

I selected for laying down the most tenacious soils on the farm, and some hilly portions difficult of cultivation. Two fields were sown after a bare fallow, well dunged, and the remainder after turnips, partly eaten on with sheep. I generally sow in April—the light seeds first, and then the heavy

ones the reverse way. I have always sown with a crop, and have found the following mixtures succeed well :—

Seeds for Shaly Soils.

2 lbs. Sweet Vernal.
3 ,, Crested Dogstail.
2 ,, Meadow Fescue.
3 ,, Cocksfoot.
2 ,, Sheep's Fescue.
2 ,, Tall Fescue.
2 ,, Rough-stalked Meadow-grass.
4 ,, White Clover.
2 ,, Alsike.
2 ,, Ribgrass.
8 ,, Perennial Rye-grass.

Total—32 lbs.

Seeds for Very Stiff Soils.

4 lbs. Crested Dogstail.
1 ,, Sweet Vernal.
3 ,, Cocksfoot.
4 ,, Tall Fescue.
4 ,, Meadow Fescue.
3 ,, Rough - stalked Meadow grass.
2 ,, Meadow Foxstail.
4 ,, Timothy.
2 ,, Alsike.
2 ,, White Clover.
6 ,, Perennial Rye-grass.
5 ,, Italian do.

Total—40 lbs.

I have generally sown artificial manure with the seeds, and limed the following spring. The crop should be mown early the first year, and not eaten too bare with sheep. My altered mode of farming pays me better than my former practice. I save the keep of two horses, and the expenses of about a man and a half: my breeding-stock of cattle and sheep are considerably increased.

My landlord (the Earl of Powis) found seeds for 12½ acres, on condition that the land should not be ploughed up again.

My experience is that land certainly need not be so dry for grazing as for arable farming: I consider that many pastures are overdrained, and that some of my own suffer in that respect.

With regard to artificial grasses in rotation, I seldom let them lie more than one year.

My permanent pastures I find pay me to improve by the application of bone-manures and compost, and by the consumption of roots and purchased food for sheep upon them: but I must confess that bones have not had so much effect as I looked for. Yard-manure produces good results.

Since writing the above, I have used a mixture of 3 cwt. kainit, 2 cwt. bone superphosphate, and 1 cwt. of nitrate of soda per acre to lately seeded pasture, with very good results.

John Shuker.

19. Holker, Cark-in-Cartmel, Lancashire.

In 1854, not being able to meet with a suitable tenant, I took in hand a poor cold clay farm, belonging to his Grace the Duke of Devonshire, which had previously been let at 19*s.* per acre, but upon which no tenant ever did any good. I broke it up out of grass, gave it a summer fallow, applied 4 cwt. per acre of Peruvian guano, and sowed it down with mixed grass-seeds, without a crop. Since that time portions of it have been top-dressed. It was then let in separate lots for a time, but is now in one farm, at 30*s.* per acre. I have also laid down about 130 acres of land, reclaimed from Morecambe Bay: this has gone through a regular course of cropping, and been sown down, generally without a grain-crop.

My opinion is that land of this description will pay best in grass. Good

loamy soils I should keep under cultivation, for where such are laid down less stock will be kept.

Grass-seeds I would sow in July or August, and, as I have already said, I would do this without a grain-crop. If weak, I would mow the young seeds, but certainly not pasture with sheep.

The average rainfall of this district is 45 inches.

GEORGE DREWRY,
Agent to his Grace the Duke of Devonshire.

20. REAM HILLS, KIRKHAM, LANCASHIRE.

My farm of 280 acres I have on a yearly tenure, under the Earl of Derby. Half of it consists of a strong free soil, resting on a clay and marl subsoil, and the rest of it is moss-land, part of which has been recently reclaimed. Our rainfall averages 33 inches. About 60 acres have been in permanent grass for fifteen years, and 90 have been laid down during the last four years. I was induced to extend my breadth of grass land by the high price of fat and lean stock, and by the increased cost of agricultural labour. The fields I selected for sowing down were of the heavier class, as these soils always retain the permanent grasses best; moreover they are expensive to cultivate. I have always mixed the seeds thoroughly and sown in April, with a corn-crop, allowing it to ripen. I have found the following mixture of seeds do well, viz., perennial ryegrass, Timothy, ribgrass, cocksfoot, foxtail, meadow-fescue, cowgrass, white clover, alsike, and trefoil. This dressing is particularly adapted for heavy land: on lighter soils I would use the same sorts, but increase the grasses and lessen the quantity of clovers. I never mow, but pasture with sheep and young cattle, keeping the seeds well eaten down. During the first three or four years I would dress well in spring with boiled bones and a little nitrate of soda. I apply all the farmyard-manure on my arable land. Since I have laid down so much land I have considerably increased my stock.

Old pastures will pay well for improving, and this may be best done by applying bone-manures and composts, and by feeding sheep upon them with corn, &c.

My experience teaches me that pasture land should be well drained.

PETER BLUNDELL.

21. THE GRANGE, WORSLEY, MANCHESTER.

My farm of 445 acres I rent under a six months' notice, and without any tenant-right. About three-fourths of my holding consists of old bog-land, reclaimed from Chat Moss, while the remainder is a mixed soil, with a portion of sound average land. Having already 140 acres of permanent pasture, 100 of meadow, and 205 of arable land, I have not laid down any portion to grass. In fact when, in two instances, I did attempt to do so, I failed; for this land I find will always revert to its original character of herbage. I have, therefore, of late years simply sown the usual mixture of clovers and Italian rye-grass, with a little trefoil; and this, after mowing once, I leave in pasture one, two, or three years, according to seasons and the condition of the seeds. This being a large dairy and root-growing farm, the system is varied only to try and make the most of everything, and so meet increased and increasing expenses. Here, within the past $2\frac{1}{2}$ years, labourers' wages will average a rise

of 3*s.* per week; blacksmiths, 50 per cent.; carpenters and other mechanics, 25 per cent. Add to this larger local rates, re-valuation, and advance of rent, amounting in some cases to from 10 to 16 per cent., and you may safely put down the tenant-farmer's cost of production as having advanced 30 per cent. during the last three years!

With regard to the best method of improving old grass and meadow, "foddering" stock upon them is a valuable agent; but I have found nothing equal to or last so well as good home-made manure from highly-fed stock, well rotted by constant saturation with tank-water. Where, however, this cannot be spared from the arable land, judiciously mixed top-dressings may be substituted, and will be found to pay well for the outlay. My impression is that the grass land in this country does not receive near the attention true policy dictates.

Touching the degree of dryness desirable for grazing purposes, all herbage is undoubtedly sweeter upon drained than upon undrained land; but I have seen instances where both meadow and pasture have been *over-drained.* And it is yet an unsolved problem how it is that much of the land in Cheshire producing the very best quality of cheese is often in a very neglected state, growing little else but rushes and other coarse herbage.

HENRY NEILD.

22. TATTON PARK, KNUTSFORD, CHESHIRE.

We have, from time to time, laid down a large breadth of land to permanent pasture on Lord Egerton's home-farm.

The grass seeds, for economical reasons, are always sown with a grain-crop, which is allowed to ripen. The land intended to be laid down would, in the preceding year, have been under roots, which, owing to the soil and climate not being adapted to their being consumed on the land, would have been carted off.

Sowing without a crop, and sowing with rape (2 lbs. per acre), have also been tried. My own opinion is that, provided the land be in good heart, clean condition, and a proper seed-bed has been secured—three essential conditions—it does not much matter which of the three methods be used.

The seeding, whether with or without a crop, should be done at the end of March or beginning of April, depending on the weather; the surface must be fine and moderately dry, and the light and heavy seeds sown separately. It being above everything necessary that the land should be thoroughly clean, it is sometimes requisite to defer sowing the grass-seeds until too late for a grain-crop; in such case they may be sown alone, and may succeed very well, even when put in as late as July or August; but I prefer the earlier months mentioned above.

Our mixture varies with the nature of the soil. The following has been lately used with much success:—

Per acre.		Per acre.	
½ bush.	Cocksfoot.	4 lbs.	Smooth-stalked Meadow-grass.
½ ,,	Foxtail.	3 ,,	White Clover.
⅓ ,,	Pacey's Perennial Rye-grass.	2 ,,	Trefoil.
¾ ,,	Meadow Fescue.	2 ,,	Timothy.
2½ lbs.	Sweet Vernal.	1½ ,,	Cowgrass.

Some land grows cocksfoot so strong that it makes the herbage too coarse, and it is consequently omitted. In some cases 2 lbs. of rib-grass may be advantageously added to the above.

The young seeds should be mown the first year, the next year depastured with young cattle, *not sheep.* Top-dress in the second year with, say, 2 cwt.

per acre of bone-dust, and continue the application annually until a good close growth of clover is established, after which a less frequent dressing will suffice.

Strong land answers best in grass, while light soils are more suitable for tillage.

As to drainage: an opinion is occasionally expressed, that land taken for permanent pasture may be over-drained, but I think it is an old-fashioned prejudice. Our permanent pastures are kept up by the application, from time to time, of top-dressings of bone-dust, mixed occasionally with a small proportion of guano, sulphate of ammonia, &c., but no manurial treatment seems to be efficacious in this climate in preventing permanent pasture on some soils, more especially light ones, from deteriorating, and in ten or twelve years' time the plough has to be again used.

GEORGE CARTER,
Estate Agent to Lord Egerton of Tatton.

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23. BRASSEY GREEN, TARPORLEY, CHESHIRE.

I am owner and occupier of 173 acres of land, all in grass. The soil, with the exception of 2 acres or so, is stiff, with strong subsoil, lying upon a good bed of marl. Long before the rise in the price of agricultural labour, and before stock had attained its present value, I adopted my present mode of farming, convinced that it would pay better than ploughing. My experience has proved that I was right. My land is all well drained, at an average depth of 26 inches; this I consider deep enough for permanent pasture, though if it were under tillage I should prefer 3 feet. I generally mow only about 40 acres (I have only mowed 34 acres this summer); the land being good, this gives quite sufficient winter keep, excepting in a very dry summer, when I have to purchase a little wheat or oat straw. For a length of time I have dressed the pasture land about every fourth year with 7 to 8 cwt. of boiled bones per acre, but now I mix with mineral superphosphate, and with good results. All my hay-grass, with the exception of one field, situated half a mile from the homestead, is grown with farmyard-manure; in addition to which I cover 4 acres of dairy-land with manure from the pigs, which greatly enriches the soil. I have found, from experience, that land which has been down in grass for fifty or sixty years requires a larger outlay to keep the herbage sweet than such as has been under tillage within twenty years or so; but the older grass is more valuable for wintering young stock, as it carries so much better. In my opinion stiff clays are not adapted for tillage; but deep loamy soils may be used advantageously for that purpose.

My present number of stock is 105 head of cattle (I had 113 head of cattle in the early part of the season, but have lately sold 8 fatted beasts), all 2 years old and upwards, excepting 7 yearlings; over 20 sheep, and 3 horses. I milk about 50 cows. From 50 cows I made 12 tons of cheese last year, long weight: but, in consequence of the drought, and scarcity of grass, I expended 45*l.* in feeding stuffs, and gave the cattle $11\frac{3}{4}$ acres of mowing; but I expect to exceed this amount this year from the usual quantity of pasture-ground, and without any extra feeding, though nearly half of my dairy stock have suffered from the foot-and-mouth disease. The rest of the cattle are for feeding and store purposes. Three men compose my regular staff of labourers, except in hay time, when I get additional hands.

My cattle milk and grow well. All my fattening is done on grass, consequently at a light expense. I do not rear my calves, but purchase stirks

and young barren cows for fattening, and chiefly fill up my stock in the autumn with such as are not specially adapted for the butcher. Now that all my land is in grass, and since I have so much improved its fertility, chiefly with bones, the farm will carry nearly double the quantity of stock it did 51 years ago; consequently the production is greatly increased, and the remuneration very much larger.

JOSEPH ASTON.

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24. RUSHTON, TARPORLEY, CHESHIRE.

I rent my farm of 145 acres on a yearly agreement, but without any compensation clauses. The soil varies, but is chiefly a good brown loam on a marly subsoil, with part on rock: about 20 acres are gravelly, and this is all that I now have in tillage. The rest of the farm is in grass, and, were it all heavy land, I should certainly have none under the plough. A few years ago I had a larger quantity of arable land, but the dearness and scarcity of labour caused me to lay it down. My practice has been to get the land as clean as possible during a rotation of oats, green crop, wheat, and then oats or barley, and to sow the seeds in April with the latter crop, which is allowed to ripen. I always sow the light and heavy seeds separately. As soon as the corn-crop is taken off, I dress the young seeds with farmyard-manure or bones—the former preferred. The first crop of grass I mow, and then pasture with cattle or sheep; and in the following spring, apply a few bones. I now rear and feed a good deal more stock than I did formerly, and am certain that my present method of farming pays me better than when I ploughed more of the land.

Light soils lying long in grass would become foul if not heavily stocked and manured: if, in spite of this, the land becomes foul, the only way to clean it is to put it through a course of tillage.

Marling and boning, and consuming turnips on old pastures, have each their beneficial effect, and they will pay well for the outlay.

THOMAS FINCHETT.

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25. RIDLEY HALL, TARPORLEY, CHESHIRE.

I rent this farm of 445 acres on a 21 years' lease, dating from 1857. I am not protected by any tenant-right clauses; but I think it important that every lease should contain a clause giving the tenant compensation for improvements made within a certain number of years before the termination of such lease; for, where this is neglected, it cannot be expected that any prudent farmer will continue to lay out much of his own capital as the expiration of his occupation draws near.

Some of my land is of a stiffish surface, resting on a strong clay subsoil; portions consist of a sandy loam, upon gravel; while the remainder is a black peat, lying at a low level, having evidently at some period been under water.

I cannot give the exact yearly rainfall, but I should say our climate is a medium one as regards moisture.

Previous to 1866 I had put down in grass about 60 acres; but cattle-plague coming amongst us at that time swept away the stock, and caused me to break up about 100 acres, which I have since reduced to 50 acres. The main cause of my wishing to have less ploughing was not the high wages of the labourers proper (for in this immediate neighbourhood we do not suffer so much in that

way as is the case in some localities): but the great scarcity of the men and women servants whom we hire by the year to live in the farm-houses, and whose services, where the dairy-farming is extensively practised, cannot be done without. I have been enabled, by my altered system of management, to dispense with six of these (three men and three women), and also with three ordinary labourers. The wages of the hired (young) men have lately advanced fully one-third, while labourers get 3*s.* to 4*s.* a week more; and therefore I effect a considerable saving in this way. I also keep three farm-horses fewer than formerly.

In preparing the land for seeding-down, my plan has been first to clean it thoroughly with a well-manured green crop. I have occasionally tried beans, but I prefer roots, as being more easily cleaned. In this neighbourhood, where early potatoes are much cultivated, I have seen land sown down at the end of June or beginning of July, after these have been removed, and with good results. This I believe to be the best plan of securing a good thick root of permanent grasses and clovers, and I would add a sprinkling of rye, or rape, or vetches, to be eaten green by sheep. A corn-crop, where land is in heart, is almost certain to become lodged, and invariably smothers the young plants. Messrs. Sutton and Sons, of Reading, have, at a cost of about 20*s.* per acre, supplied me with a permanent mixture suited to the kind of soil under treatment, and I have always found it best to sow the light seeds separate from the heavier ones.

During the first autumn, or if sown along with a grain-crop, as soon as the latter is harvested, the newly made pasture should receive a dressing of about 7 cwt. fine bones and 3 cwt. superphosphate per acre, and be then for two years depastured as much as possible with cattle. Sheep, by biting too closely, are liable to destroy the tender plants, and, if allowed on at all, should not be permitted to remain too long. If carefully treated and occasionally top-dressed, I certainly maintain that grass recently laid down will increase rather than diminish in productiveness as the turf acquires maturity.

My old grass and meadow land I have also improved, first by draining, where necessary, and then by laying on bones and farmyard-dung. I always endeavour, by consuming the whole of my hay and straw on the premises, to swell the manure-heap as much as possible; and as, besides using most part of my own oats, I purchase considerable quantities of cotton-cake, Indian corn, and bran, what I produce is of a very superior quality. Having but a small proportion of tillage-land, and yet making a deal of manure (for I keep also a large number of pigs), I generally manage to apply dung not only to the whole of the root-crop, but also to the clover-root, as well as a portion of the grass land or meadow; and where I cannot do this, I have recourse to the best artificial compounds. I usually mow about 30 acres of meadow grass annually, taking care that the land does not go longer than two years without a dressing of well-made dung, a fertilizer on which I place great reliance.

CHARLES WILLIS.

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26. YOULGREANE, BAKEWELL, DERBYSHIRE.

My farm of 677 acres I rent from year to year, with a "tenant-right." It is chiefly a brown soil, with limestone cropping up to the surface in a few places. I have long made a practice of laying portions of land down to grass. About half my farm is arable, but I am convinced that it would pay better if the whole were pasture, except a few acres kept to grow corn and roots. After ploughing out any grass land, my plan has been to grow two crops of oats, and then a crop of turnips, manuring with 4 quarters of bones and 5 cwt. of salt per acre; the year following I lay it down with rape and seeds, and, if good,

let it lie for eight or ten years. The great thing in laying land down is to have it clean and solid, with a fine tilth, otherwise the seeds cannot grow. I always mix my own seeds as follows:—14 lbs. of small seeds, and 1 quarter of home-grown hay-seeds, and sow with $1\frac{1}{2}$ lb. of rape, and pasture the young seeds with sheep, of which I am year by year rearing a larger number. In the second year my seeds are generally very early, and are valuable for the milking cows.

I consider that, where requisite, all land should be well drained. I have not received any assistance from my landlord in laying down grass.

I have not altered my system of farming with regard to the arable land, nor my mixture of artificial grass-seeds. As to land becoming foul under grass, I maintain that that can be avoided, provided it is once well cleaned, by being particular in the selection of good clean seed.

I endeavour to keep my grass land in heart by consuming upon it "chop," roots, and artificial food. The harder land is stocked, provided the stock are well supplied with feeding-stuff, the more it will carry. I use the farmyard-manure for growing two or three acres of cabbages, and a few potatoes, while the rest is put on the meadows. All my turnips I grow with bones and salt; but if, in spite of the artificials consumed by stock on a pasture, I find it is not grazing well, I apply a little salt, manure it, and mow for a year or two, which quite changes the herbage, and improves the field immensely. Of course while doing this I have to pasture some of the meadow land. I can now keep far more stock than when I entered the farm nine years since.

JOHN ARCHER.

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27. HARGATE HALL, BUXTON, DERBYSHIRE.

I farm 360 acres of my own property. The soil varies from a good rich loam to a poor thin red, or, as we call it, "fox-soil," on limestone-rock; and in parts we have "Dun-stone" and clay. Our average rainfall is 51 inches.

I commenced laying land down on my present farm in 1860. At that time my holding consisted of

80 acres arable.	160 acres permanent pasture.
70 ,, meadow.	50 ,, sheep walk.

In 1874—

25 acres arable.	225 acres permanent pasture.
60 ,, meadow.	50 ,, sheep walk.

It will therefore be seen that I have laid to permanent pasture 65 acres; and I have done this because I consider that in this district it pays better to grow cattle than corn, the climate being too cold and wet for the latter. On land which I intended laying down I have sometimes taken two, or even three crops of oats, well manured with guano and artificials. This has had a good effect in well breaking up the land, and making the process of fallowing easy; but it does not answer well, even with a liberal supply of bones, as the land goes so sad after two or three years, and the herbage becomes poor and thin. The best plan is to take one crop of oats, then fallow and sow down, and lay on bones.

I prefer sowing in April, light and heavy seeds together, using my own old meadow grass-seeds, and a mixture of clovers, rib-grass, trefoil, and rape. It is better to sow with rape than corn, as the liberal supply of bones and other manure requisite to put the land in heart for the young grass, often "lays" the corn, which then rots and spoils the seeds. Before laying down to grass land should be thoroughly drained: this I consider as necessary for pasture as

for tillage. I have not tried the "inoculation" system, but, from what I have seen, do not approve of it.

Young seeds should be depastured, as being the best way of keeping the land in good condition.

I find that my farm pays me better now than it did under the former system; and yet to winter a large stock entails a heavy outlay in purchased food, and in cutting, steaming, and pulping, so as to make the smaller quantity of straw grown go as far as the larger formerly went. I am able to keep fully two-thirds more cattle, but not more sheep. Our grass, much of which is strong and rank, is not adapted for sheep, though it is all we could desire for cattle.

As regards the improvement of old grass, there is no doubt that lime, where it can be easily obtained, is invaluable; it is the best, cheapest, and most permanent manure. Bone-dust is a good fertilizer, and is easily applied; and green forage-crops, roots, &c., consumed by cattle on land which grows rough tough grass, have a good effect.

I mow the same meadows every year. I am well repaid by improving my grass land. I can keep more cattle, and what I breed are as good now at two years old as they used to be at three years.

THOMAS SWANN.

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28. ALDWARK, WIRKSWORTH, DERBYSHIRE.

My farm of 470 acres I rent from year to year under the Duke of Rutland. The subsoil is limestone. I have laid down more or less land to pasture for 32 years, as I find it advantageous to diminish the area under plough. I have generally selected fields furthest from the homestead, and those too thin in soil for frequent ploughing. I prefer to lay land down with a crop of rape after liberally manured turnips, rather than with a white crop. I sow light and heavy seeds together between the 6th and 18th of May. I like my own old meadow seeds, with the addition of from 3 to 4 lbs. of red and white clovers per acre, better than any bought mixtures. Where a turnip crop has not immediately preceded the rape, I apply, at the time of sowing the latter, 4 to 5 quarters of crushed bones per acre, adding about 4 cwt. of Proctor and Ryland's grass-manure to give the grass-seeds a start. I should not mow during the first three or four years if I thought cows and sheep would eat the seeds bare enough. I have sometimes eaten them till May, and then, if they have been too strong, mown about the middle of July. I have done all this laying down to grass at my own expense; and, although I have made no particular calculations, I am satisfied that this mode of farming pays better than my former practice. If grass will take on heavy soils I should certainly keep the more friable under the plough. I consider land should be made as dry for pasture as for corn and roots.

The land which still comes under a rotation of crops I keep down longer in grass than I used to do.

Bones applied to old pasture answer well in this county, but there is nothing better than good farmyard-dung, if one could but get it. Consuming turnips upon it does good, provided the land is thoroughly dry. My grass land, since it has been improved, pays me better than formerly; and the increase in my head of cattle is considerable.

BENJAMIN BUXTON.

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29. SHELTON, NEWARK, NOTTINGHAM.

This county being more a corn-growing than a grazing district, with a dry climate, generally dry soil, and a short rainfall (averaging 27·5 inches), as compared with many other parts of England, it is not to be expected that

much progress will be made in laying down land to permanent pasture; and if attempted to any extent it will, I believe, be an enforcement caused by the increasing expense of labour, and a step that will not be to the advantage of either producer or consumer. Indeed, I should consider it a retrograde movement, though possibly in a more moist climate it might be otherwise.

Where land in this county is laid down in any appreciable quantity, it can hardly be expected that the tenant should do the work without some assistance from his landlord. A very considerable loss would be incurred while the grass was getting established, unless there were a corresponding advantage through permission being given to break up other land. I believe there are in this county tracts of poor tenacious clays and light sandy soils which, if laid down in grass, could not after the first three or four years pay any rent at all; indeed, I know of only a very limited extent of land that could be laid down to advantage. I have noticed, in some districts, portions of hilly land naturally disposed to go into turf; and where such lie at a great distance from the farm premises advantage might rightly be taken of these circumstances to increase the extent of pasturage.

In laying down land to grass, my experience and observation teach me that, where necessary, it should be first properly drained, and all bottom water and deep springs removed. I would then cultivate deeply, and give a clean bare fallow, so as to get the land thoroughly pulverized; then apply 2 tons of lime per acre if the land is deficient in lime, and sow the grass-seeds early in spring. If lucerne is not sown with them, a thin seeding of beans, oats, or barley may be used; but if no corn is sown the operation will be more likely to succeed, from the fact of a greater amount of moisture being retained. I have tried both plans side by side, the result from the piece without the corn being the more satisfactory; the advantage in the one case being quite equal to the value of the corn-crop in the other.

As to seeds, I would recommend to avoid the expense of sowing the finer kinds not natural to the district; for even if they appear at all they only remain for a short period; whereas the kinds indigenous to the locality must, if encouraged by liberal treatment, eventually succeed. Avoid grazing too closely with sheep, and mow early. Give frequent light top-dressings of any kind, if even it be refuse manure. I have laid down at different periods on my own farm several pieces of permanent grass. The soil is a good clay loam, well drained. Upon two of these plots, as soon as the land was sufficiently dry in the spring, I drilled from 16 to 20 lbs. of lucerne 1[illegible] to 14 inches apart in the rows; and then sowed, broadcast, grass-seed suitable to the soil, avoiding, however, too much perennial rye-grass, and leaving out entirely the Italian; in fact, white clover and cocksfoot formed a large proportion of my mixture. The lucerne cut a light crop the same autumn, and in May or June following, as the season allowed, a good crop of green fodder was cut, followed by two or three other cuttings during the summer and autumn. Upon two other portions, the lucerne only was drilled it was constantly cultivated between the rows, and mown green for three or four years, and then the grass-seeds were sown: the latter plan answered best Lucerne with me is a valuable crop, this soil being peculiarly suited to it; it seemed to encourage the grass-seeds, which had become thoroughly established by the time the lucerne died out.

Frequent top-dressings, as I have said before, are necessary for new pastures, and liquid manure I have found of great benefit, especially when applied in spring.

I have in one instance known "inoculation" answer well; in another noticed that it was an expensive and by no means satisfactory operation I have not myself had courage to try the system, and therefore cannot speak

rom experience, but I could not recommend it to any extent upon naturally lry soils, in a dry climate. I do not expect that, upon farms where turnips ınd good seeds can be grown, more stock can be kept per acre by laying down ıny great breadth to permanent pasture; because the extra quantity of keep ıpon the turnips, and the first and second years' seeds, would be lost: indeed, ıpon extremely light soils I believe much less stock would be kept. Some of ıs in this district have made an alteration in our mixture of seeds for alternate ıusbandry, with the view of letting the land lie longer in grass; say two, hree, or even four years, instead of one: and should the present high rate of abour and other expenses of cultivation continue, this practice may be more generally adopted. Moreover, we find that the land is benefited by this rest rom constant corn-growing.

The altered system, doubtless, has a tendency to foul the land, but we can emedy this by breaking up the seeds, and cleaning the land soon after Midsummer.

The improvement of permanent grass is certainly a desirable object, and is ıt this time second to none in the agriculture of England. The difference in value between good and bad, or even moderate, grass land, seems seldom kept in view. Its improvement, however, is not so often attempted by tenant-armers as is that of their tillage land, because a longer time is required to bring it about, and therefore a return for their outlay is not so quick; so much nore necessity is there, then, for security of tenure.

Liberal as our Nottingham custom of tenant-right may be upon some points, t would allow no compensation under this head; and yet the letting value of he land might, solely through the tenant's enterprise, be increased 100 per ent. To secure compensation from the incoming tenant, manurings must ıave been very recent, and boning and draining executed within seven years.

I am inclined to believe that, although rapid progress has been made during he last thirty years in improving the tillage land of this county, the grass and, upon the whole, has not been improved at all; but, in a great number of cases, it has actually gone back, and not unfrequently from that almost xcusable practice of overstocking with sheep.

Very recently, however, through the introduction of cotton-cake to this ountry, the system is becoming general of consuming large quantities of it, as vell as of linseed-cake, upon grass during the spring and summer. This, it is o be hoped, will rapidly bring about a better state of things, the present high price of beef and mutton being a stimulant in this direction. The first step, ıowever, towards improving grass land is the taking away, where it exists, the old bottom-water, as by this means the poor, worthless, sour grasses and ushes disappear, and a better class of herbage takes their place; the land may hen be safely treated with a liberal application of manure.

Almost every kind of refuse-manure, which may be valueless for tillage and, will do good upon grass, if applied at the proper season and well harrowed n: by this means I have even mastered moss. Lime and bones are of ındoubted benefit upon many pastures; but even these cannot be applied ndiscriminately; I have used both upon some soils without being able to see he slightest effect. Generally speaking, there is nothing equal to farmyard-nanure for grass. My plan has been to use a large quantity in this way, ubstituting artificial manures for the roots and corn. Meadow land should be mown continuously, rather than in alternate years, the quality and quan-ity of the crop being maintained by either a dressing of farmyard-manure r artificials every season.

I consider that, in time, much will be done in suitable situations by the torage of water, and working it on the "catch-water" system.

John Hemsley.

30. Oxton Grange, Southwell, Nottingham.

I occupy, as yearly tenant, but subject to the Nottinghamshire tenant-right, about 454 acres.* Our rainfall, which in 1872 reached 39·54 inches, averages, for the last seven years, 27·48. I have seeded down, during the last twenty years, several pieces of land, chiefly strong clay of bad quality, which, even when wages were lower, did not pay me for cultivation.

In preparing land for pasture I strongly recommend a good summer-fallow, so as to get it thoroughly clean, and, weather permitting, the seeds should be sown in August of the same year. Seeds will do better provided a white crop precedes the fallow, as I have seen them do badly when the previous year's crop had been tares or other pulse. Land may, however, be seeded at any time between February and August, taking advantage of suitable weather. My own seeds, which were selected for me by a seed merchant, having regard of course to the character of the land, were sown with a thin crop of barley, which last helped to pay the expense incurred. I have seen permanent seeds sown with rape, or with a crop of short-straw peas, answer quite as well as without a crop, always taking care that such crop be thinly sown.

In all cases where land is intended for permanent pasture lime should be applied a month or two before seeding, keeping the lime as near the surface as possible, and evenly spread. In no case pasture young seeds with sheep as long as you can avoid it. As a rule, I prefer that seeds should ripen before being stocked the first year, especially if the season be dry. At the end of the first summer a mixture of soil, lime, and manure, previously prepared (as I think this preferable to manure alone), should be applied. Newly laid down grass will often be found to fall off, both in quantity and quality of herbage, after the first three or four years, and it is then that some farmers feel tempted to break the land up again. This, however, should not be done. Rather apply another dressing of the soil and manure, chain-harrow this in with a few fresh seeds, and give it a longer trial.

My landlord now finds seeds for any land laid down by his tenants to permanent pasture.

I should advise seeding down strong soils of bad quality, and keeping in cultivation land that will grow roots and barley: and I think it quite as important for clay land to be thoroughly drained before seeding as for arable purposes. Patches of a field perished by wet will generally be observed to be the first to burn in dry weather.

I have not myself tried inoculation, but believe the process is considerably more expensive than seeding down; besides, a serious damage is done to the land whence the turf is taken. About thirty years ago a piece of land at Oxton was inoculated, the sods being taken from good land on to bad, which latter is bad to this day. A piece of land adjoining this was seeded in the ordinary way, and there is now very little difference in the two plots.

With regard to the arable portion of my farm, my system has always been to keep it two years in grass: it is then attended with less expense in labour and purchased tillages, more stock is kept on the farm, and consequently the land is maintained in better condition. Occasionally, where there is a good

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* I may add that the tenant-right custom prevalent in this county, good though it is in most respects, is deficient as regards grass land, as, in cases where land has been seeded down to permanent grass at the sole expense of the tenant, the latter would, on quitting, receive only three or four years' tenant-right; or, in some instances, half the seed-bill, in addition to any unexhausted tillages he had applied. My opinion is, that in such cases (provided the work has been well done) twenty years' tenant-right should be allowed to the outgoing tenant, in addition to any unexhausted tillages applied; such compensation to be paid by the landlord, as being a permanent improvement to the farm.

take of seeds, I may leave it down three or four years. My permanent grass I improve by consuming upon it by stock a large quantity of roots and purchased food, also by applying a mixture of lime, manure, soil, and refuse of all kinds. I may mention, however, the good effects caused by paring and burning a piece of grass land in July after the hay had been carried. I had the ashes equally spread, and the land seeded down in August; and, strange to say, the grass was ready for the scythe the following spring before any other green food on the farm. Previous to this experiment not a root of clover was to be seen on the piece, but now, although it is some ten years ago, it is full of that valuable plant, and I therefore consider this an excellent method of renovating rough grass land.

With regard to meadows, I prefer to mow every year rather than mow and pasture alternately, manure being of course applied accordingly. There can be no doubt that to enrich grass land pays as well as improving the arable, and some landlords in this district have assisted their tenants in this step by supplying them with bone-dust. I am satisfied that grass land may, by a judicious outlay, be made to carry one-third more stock.

John Brett.

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31. Burghley House, Stamford.

I have in hand, including the parks, about 1500 acres of my own land. The soil being light, with a sandy subsoil, it is well suited for the growth of turnips and barley. I have not laid down any portion of my land, but have lately given much attention to the old pastures. In one field I began by paring and burning part of it; the rest I ploughed, and tried turnips sown by hand, but owing to dry weather and wire-worm I did not get a crop. I then fallowed it, and am satisfied that this is a capital plan, as the rooks got all the wire-worm. In the following year, 1869, I got a splendid crop of oats; in 1870 oats again, a good crop; in 1871 I sowed turnips, with 2½ cwt. artificial manure, and 6 bushels of bones to the acre: the result was a very heavy crop. In May, 1872, I sowed permanent seeds with rape. I consider a sprinkling of rape eaten green more favourable to the seeds than a grain-crop allowed to ripen. I depastured up to the first or second week in August, then allowed the grasses to seed and ripen; and chain-harrowed at the end of September, thus causing a large fall of seeds, which, by the aid of the autumn rains, vegetated, and vastly improved the pasture. This field I can now state has kept four times the quantity of stock it carried previously to being broken up. I may add, this field is now (August, 1875) grazing very well indeed, having had nothing but cattle allowed on it in the summer. I consider sheep do harm to land newly laid down to permanent pasture by eating too bare the fine grasses, thus preventing their full growth and chance of increase by seeding. I should say that land having a strong subsoil will pay better in grass than under the plough; but I do not consider that land requires to be so dry for grazing as for arable purposes.

I have not increased the extent of pasturage on my arable land, nor altered my rotation; but by adopting an improved mixture of grass-seeds I never fail in securing a crop, which, if cut for hay, furnishes a much larger bulk of winter keep, and a good aftermath for sheep; or, if grazed, it carries nearly double the quantity of stock. The mixture of seeds which I have found so successful is this: 4 lbs. red clover, 3 lbs. cow-grass, 1½ lb. trefoil, 1½ lb. white clover, 1½ lb. alsike, 4 qts. Italian rye-grass, and 3 qts. of cocksfoot per acre. Much care is required in the selection of seeds, especially Italian rye-grass, which, as every farmer knows, closely resembles twitch. Foul land, when I have had such, I have found easily cleaned by using the broad-share on the stubble as soon as possible after harvest.

Exeter.

32. Lambton Castle, Durham.

I manage, on behalf of the owner, the Earl of Durham, 1784 acres of land. The soil varies; it is chiefly loam, with portions of light land and occasionally heavy clay. The rainfall averages about 25 inches. Since the year 1860 I have laid down about 80 acres to permanent grass. This I was induced to do for several reasons, viz., on account of the increased price of stock, the dearness and scarcity of labour, and the need of more grass and hay for the colliery horses. Heavy land being most costly to work has generally been selected for converting into permanent pasture. My preparation for the seeds has been to take a crop of oats out of lea, then fallow, well draining, cleaning, and deeply cultivating the land; also liming and manuring. I consider it of equal importance to have land thoroughly drained for grazing as for arable purposes; say 4 feet deep, and in strong land on clay subsoil 6 to 8 yards apart. The light and heavy seeds, composed as follows, have generally been sown together in the month of April:—

¾ bush. Perennial Rye-grass.	1 lb. Cocksfoot.
13 lbs. White Clover.	1 ,, Sweet Vernal.
10 ,, Trefoil.	1 ,, Meadow Foxtail.
4 ,, Alsike.	1 ,, Hard Fescue.
6 ,, Cowgrass.	1 ,, Smooth-stalked Meadow-grass.
3 ,, Red Clover.	
1 lb. Crested Dogstail.	

The seeds have always been sown without a crop, and been depastured during the first two or three seasons with sheep and young cattle, and top-dressed with artificial manures.

With reference to the rotation of crops on the arable part of the farm, I have somewhat altered it by allowing the land to remain in grass three years instead of two; and with a view to this I have added cocksfoot, Timothy, foxtail, and trefoil, to our former mixture of seeds. By being careful to have land clean and in good condition before sowing the grass-seeds it will not be found to have become foul when next broken up.

The old permanent grass on this farm has been improved by the application of manures, and by the consumption on the land of roots and artificial food. We mow portions of the grass land every year for the colliery horses, and depasture the remainder with cattle and sheep.

W. Steward, *Farm Manager.*

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33. Croxden Abbey, Uttoxeter, Staffordshire.

The extent of my present occupation is about 630 acres; but while I have been for twenty years familiar with the management of the whole, one-half was, until within the last two years, in my late father's occupation. Twenty or more years ago the process of seeding down permanently was commenced, and has been continued (field by field) up to the present time, when I may say about 108 acres have been laid down. I have selected for grazing purposes such fields as, with our somewhat damp climate (our rainfall is about 35 inches), were unsuited, except in special seasons, for the growth of wheat or barley of fine quality, or for root-crops. On the lands laid down the grass-seeds were sown on autumn sown wheat or spring corn, after a dead fallow, or a highly-manured and well-hoed green crop carted off the ground. This year I am laying down two fields—one without a grain-crop, but with 3 lbs. of rape per acre, to be consumed on the land by cake-eating sheep; the other field was seeded in April, on autumn wheat, after green crop and fallow, the wheat being

first harrowed, then the seeds sown and rolled in. In both cases there is promise of a good set. As to the after-treatment of young seeds, I intend, upon the field seeded down with rape, to apply, in a month's time, when the seeds are well up, $1\frac{1}{2}$ cwt. nitrate of soda, 2 cwts. mineral superphosphate, and 2 cwts. kainit, per acre. Then, in the month of August, taking advantage of dry weather, before the rape gets too big, I shall put on sheep, having an allowance of cake daily; and I shall continue this next year, taking care not to graze too closely, or to have the sheep on in very wet or frosty weather. Next spring I shall repeat the dressing of artificial manures, and apply 8 or 10 loads of dung when it can be spared.

On the other field, which is a very stiff clay, I propose to apply 10 loads of good dung per acre on the wheat-stubble, and then probably mow once; afterwards grazing with sheep, also getting cake. The objection to cattle, except in dry weather, at this stage is their too great weight. I can produce no well-kept figures showing the profits of my altered system; but I am fully convinced that, upon such land as I have been dealing with, where marl and clay preponderate, and where there is but a very small proportion of gravel or sand, it pays much better to graze than to plough.

Newly laid-down pasture certainly does not, after the first two or three years, produce a large crop of grass, unless it is repeatedly helped by manure of some kind; and my experience leads me to the conclusion that there is no plan so effectual or so profitable in making new turf productive as the consumption upon it by stock of feeding-stuffs possessing a high manurial value. It is hence my custom to use in this way, all through the year, large quantities of decorticated cotton-cake, malt-dust, and other similar stimulating food.

I prefer to keep under cultivation such land as is best adapted for the growth of green crops and corn, and which can be worked with a moderate amount of horse-labour. It is *most unprofitable* to plough poor clay soils; no matter *how low the rent,* it does not pay. The difference in the value of the crop and the cost of producing it on such land, as compared with good arable soil, will amount to many pounds per acre! I grant that if put down in grass, such land may not at first do much; but, at any rate, the heavy yearly expense of tillage is saved. And I need hardly add, that the increased cost of horse-flesh and the enhanced price of agricultural implements tell with greater force upon the unfortunate cultivator of strong clay land. The above remarks do not altogether apply where the land is laid out for steam cultivation, and the climate is more suitable to the growth of corn.

With regard to artificial grasses under rotation, it has for many years been the custom here to leave the seeds down about every alternate course for two or three years, according as the plant remained good or indifferent; and where the land so treated becomes in any degree foul, it is simply ploughed up about Midsummer and fallowed for wheat. But now that the proportion of tillage-land is much reduced, and is no more than sufficient to produce a plentiful supply of roots and straw for wintering the increased number of cattle and sheep which I am enabled to keep, my seeds remain down a shorter rather than a longer period.

Upon well-established old turf, equally with more recent pasture land, I can speak most confidently of the surprising benefits arising from the "troughing" upon it of cattle in summer and sheep in winter, with the several kinds of food already named. Some of my fields by this system, combined with occasional dressings of nitrate of soda and mineral superphosphate, have been in six or eight years transformed from sour second-rate herbage to first-class feeding land; the grass seems to grow at all seasons and in all weathers. I admit that my outlay for feeding-stuffs and manures is very high; but now that beef and mutton and dairy-produce are making extra prices, it all comes back again.

WILLIAM T. CARRINGTON.

34. Llannerch, St. Asaph, North Wales.

I have for over 20 years had in hand two of my own farms: one in Colwyn Bay, chiefly arable, containing 400 acres, including 80 of sheep-walk; the other in the Vale of Clwyd, varying from 400 to 600 acres, as it comprises land which I take from time to time from my tenants, put in order, lay down, and let off again. The soil is chiefly clay, to any depth; but some good meadows by the river Clwyd have a deposit of about 4 feet of alluvial soil, resting on gravel and clay beds. The elevation is from 50 to 200 feet, and our average rainfall for the last 7 years was 32 inches. During the past twenty years I have put down to grass about 200 acres. I endeavour to clean the land for seeds by taking at least one green crop, generally turnips. A bare fallow, followed by green crops, is the most effective, but is a method few yearly tenants can afford to practise. I have always seeded down with a thinly sown grain-crop, allowed to ripen—sometimes on an autumn-sown wheat-crop, which I prefer if the season suits, where the winter frosts have thoroughly pulverised the soil, sowing the seeds at the end of April or beginning of May. For the last few years I have used seeds obtained from the Agricultural and Horticultural Co-operative Society, 47, Milbank-street, and have found them excellent, and equal, if not superior, to any I have tried. I have laid down 80 acres in permanent pasture with them in the last four years. I prefer to mow *early* the first year, then pasture with young cattle, and not mow again. The young grass ought to be liberally treated the second and third years, and well top-dressed, otherwise the seed and labour will be thrown away. If the land is generously dealt with, natural grasses soon come up. Dissolved or ground bones answer well, especially on stiff land. I have not tried "inoculation." My experience is that the heavier lands answer best in pasture. I do not consider that any of my land in the Vale of Clwyd is profitable under the plough, although it will grow good wheat and beans. As to the requisite amount of dryness, I do not believe clay-land can be overdrained. I have drained a considerable breadth of old grass land, 4 feet deep and 30 feet apart; but that has in some cases proved too wide, causing me to put in intermediate drains at a depth of 3 feet. Alike for pasture as for arable purposes I would advise the draining of stiff clays 24 feet apart. The best means of improving grass of long standing I find to be draining, boning, and the consuming of roots and cake upon it. Through this means my deer-park of 170 acres now grazes about double the stock it did thirty years ago, and several of my fields are equally improved.

Whitehall Dod.

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35. Nantywrach, Llanrwst, North Wales.

I hold my farm of 470 acres on a nineteen years' lease. The soil is chiefly heavy loam; some part of it peat, on a clay subsoil. The average rainfall is 50 inches, and the situation over 800 feet above the sea-level. In 1866 I had 260 acres of sheep-walk, and the rest of the farm was arable land, growing oats year after year, with only a few acres of turnips. Finding that the land was very dirty and impoverished by continual cropping, and of a grassy nature, I began to lay it down, thinking I could enrich it best and at the least outlay by so doing. I prepare the land for seeding by taking two successive turnip-crops, and eating them on the field by sheep, which get also corn and cake. I then sow the grass-seeds about the end of March, together with a thin corn-crop, which, when ripe, is cut as high as possible. I always mix light and heavy seeds together, and sow 2 bushels of Pacey's perennial rye-grass, 11 lbs. of white clover, and 5 lbs. of alsike, per acre. Prior to laying down I had the land thoroughly drained, which mode of treatment I consider as necessary for grass as for arable land.

Immediately the corn is off I put feeding sheep on the seeds, giving them cake, &c.: thus the land gets well consolidated, and the young grass is not thrown out by the frosts. I never mow it, but pasture for the first three years with sheep, and afterwards with fat cattle, getting cake.

I have laid down in all about 250 acres of grass land, and I find that it pays me better now than formerly. I know of no system under which a farm of medium quality in a western district will give a better return than when kept in grass. When I entered the farm the stock were small Welsh store sheep and cattle, very few ever getting fat. My stock is now trebled in number, and consists of Leicester and Cheviot sheep, and whatever in the cattle line will pay best. The quantity of stock that newly laid-down land will carry generally increases up to the fourth year; after that no increase can be looked for. If, as sometimes happens, the herbage falls off about the seventh and eighth year, I should advise ploughing out the grass and taking two crops of turnips in succession, to be eaten on the ground, which will permanently enrich the soil My landlord drained and limed the land (8 tons of lime to the acre), upon which outlay I pay 5 per cent. In this district land of any description, if in good order, will pay well to lay down to grass. Light land, being easy to work, should, in preference to heavy, be kept under the plough, but it will require more manure.

THOS. BORTHWICK.

36. COLOMENDY, MOLD, FLINTSHIRE.

The Colomendy farm, of which I am the owner and occupier, consists of about 185 acres of grass and arable land, and about 750 acres of hill land. The soil varies from a stiff clay to gravel and sand, but is mostly a gravelly loam. The subsoil is mountain limestone, cropping out in many places to the surface. The average rainfall is nearly 31 inches. I have laid down to permanent grass about 80 acres, having been influenced in doing so by the great demand for young stock of all kinds, by the rise in wages, and by the difficulty of getting good trustworthy workmen at any price. Some of my land was difficult to work, as the rock cropping up to the surface caused frequent breakage of farm implements; I therefore selected such portions for laying down to grass.

I have found that I can get my land into the best condition for seeds, that is, in good heart and clean, in the following manner :—I take a crop of potatoes, grown with good farmyard-dung, followed by a crop of turnips, raised solely from artificials, and wholly or in part fed off with sheep. In this way the farmyard-manure puts the land in good heart, and the turnip-crop gives time for any noxious seeds that may be in the manure to germinate and be destroyed before the grass-seeds are sown.

I sow my seeds in March—light and heavy at the same time, but separately, the one lot across the other, with a drill. I have grown my best seeds with a crop of oats, thinly drilled. I harrow well after sowing the corn, and follow with a Cambridge roller; then sow the grass-seeds, which will fall into the little furrows or ruts, and a harrow following covers them nicely and at a uniform depth. I like to give young grass a heavy dressing of well-rotted farmyard-manure; but if that cannot be spared I recommend 3 cwt. of superphosphate and 1 cwt. of nitrate of soda per acre. I have found 2 cwt. of kainit, 2 of superphosphate, and 1 of nitrate of soda, to have an excellent effect. I commonly mow the first year, but before the grasses are ripe; and I put no stock into the field until there is a good aftermath, when I admit sheep and young cattle, giving them plenty of corn and cake. I keep all stock off during the winter. I am certain that the having more land in grass than I formerly had pays me well, especially in saving keep of horses and wages of men, while I am enabled to keep more stock.

For arable cultivation I should select such land as can be worked in almost any weather, and of just sufficient acreage to provide straw for horses and cattle in winter; the remainder I would lay down in grass.

As regards those seed-fields not put down permanently, I let them lie as long as they are growing well. At this time, out of 92 acres of arable land I have 34 acres in seeds; the remainder of the arable land I work in alternate green and corn crops. In consequence of letting the grasses lie for a longer term than formerly, I have added to the mixture of seeds perennial ryegrass, cocksfoot, Timothy, and white clover. If lain down clean, land will not become foul; but when found to be dirty it cannot be cured except by being broken up again. I cannot too strongly recommend the use of lime to all grass land; even in limestone soils it can hardly be used too often, or too heavily. I have, by its use, completely eradieated moss from my pastures.

I have in some instances improved old grass by harrowing heavily and then sowing white clover, trefoil, cocksfoot, and Timothy, giving a heavy dressing of soil and lime. I have also eaten a great deal of cake and corn on the land, with excellent results. Another plan is to dress with farmyard-manure, or, failing that, with 3 cwts. superphosphate and 1 cwt. nitrate of soda. Thus the value of the grass land is, I may say, doubled, as is also the quantity of stock it will carry.

G. B. Davies Cooke.

Reports from the South of England and South Wales. Collated by Morgan Evans.

1. Bagworth Park, Leicester.

I am yearly tenant of 515 acres of strong loamy land, with a red marl subsoil. My farm comprises 325 acres of arable land, and 190 acres of meadow and permanent pasture. I commenced laying down permanent grass in 1871, and have sinee completed 125 aeres. I was induced to take this course from dearth of agricultural labour, this being a colliery district. I selected the land on account of its being outlying and well watered. My plan for preparation has been (1) wheat, (2) turnips, (3) seeds, sown with a corn-crop. To my mind, land, for all purposes, cannot be too well drained. I sow light and heavy seeds all together in the month of April; some permanent seeds by themselves; some the usual rye-grasses with a great quantity of white clover, cow-grass, and alsike, &c. I would sow the seeds without a crop but for the expense. I use lime and soil, or farmyard-manure on the young seeds the second year, and 4 or 5 cwt. of bone-dust. About the fourth year the seeds are grazed. Mowing the first year gives the small seeds a better chance of establishing themselves. I find this system far more remunerative than corn growing, as I keep four cart-horses the less, save 150*l.* per annum in labour, and keep about 200 more sheep, and 70 or 80 more beasts. All this I have accomplished without any aid from my landlord. I keep the best and most convenient land for arable purposes, and lay the worst under pasture. My course on the arable land is—(1) fallow, (2) barley, (3) seeds, (4) oats, (5) wheat, so that all the arable land grows seeds once in five years, which are partially mown, partially grazed, and then broken up for oats. I have never reduced my system to figures, nor have I altered my mixture of seeds. Keeping always the same lands for the two separate purposes, it is always very clean, with little labour, as it has not time to run to filth. I improve the grass land by means of cake, and consuming roots on it. I mow about 40 acres once a year, and find grass land pays far better for manuring than arable.

George Bass.

2. Wryde House, Thorney, Peterborough.

The occupation to which the following remarks apply contains 420 acres of arable, pasture, and marsh land, the property of noblemen, let from year to year, without tenant-right. The arable is a rich dark loam or black vegetable soil, the subsoil being clay, in many places very near the surface, or even on top, with veins of silt (an alluvial deposit), and gravel. Being in the level of the fens, the average rainfall is, I believe, 24 inches.

I began laying down land to permanent grass in 1865–6. At that time the proportions were, arable land, 200 acres; marsh, 48, and permanent pasture, 172 acres; since then the pasture has been increased by 19½ acres, and 49 or 50 acres have been renovated and improved. The change was caused by the high price of meat, and the probability of grazing being made to pay a larger percentage on the capital invested, besides affording scope for employing more capital on the occupation. In laying down for permanent pasture the strongest clay-land should be chosen. I was guided in a great measure by the position of the fields with a view to the improvement of the farm. The seeds have been sown after wheat, the land ploughed in the winter, rolled, and made fine; the seeds sown late in the spring without a crop (at the suggestion of the agent) have had indifferent success. I would advise fallowing, and sowing the seeds after a fallow crop consumed on the land by sheep, lightly cultivated, not ploughed, made very fine and solid, with about half a seeding of barley, or a small quantity of cole or rape to shelter the young and tender plants from the sun and weather.

For grazing I am not in favour of drainage; I feel confident that much land in this district has considerably deteriorated in value by too much drainage. I have had the best plant of seeds when sown in May, with a green crop, the light and heavy seeds being sown separately. My only experience of inoculation has been in filling up and levelling about 4000 yards of old ditches and renovating 10 acres of inferior pasture, in which cases it was most successful, the land having been well covered in two seasons. I would advise depasturing with sheep the first year; the luxuriant growth of young grasses will answer well for ewes and lambs. Mow the second year; let the grass stand rather longer than usual, that some of the seeds may ripen and shake. I have found, as a rule, that newly laid-down lands keep but few stock after the first year—for at least the next five.

The altered mode of farming pays better than the former practice; more capital can be employed. Although I am not prepared with a tabular statement, I find, on referring to my Stock-book, that as the result of laying down more land to grass—more artificial grasses, improved methods of grazing, the extensive use of artificial food, &c.—double the quantity of sheep are kept, and about 10 per cent. more cattle, other things being equal, and the stock of the year 1865, before the cattle-plague, being compared with 1874. The number of stock kept on newly laid-down land is rather diminished than not, during the time that the grass is acquiring maturity, after the first year for the next six, at least.

The landlord supplied the seeds for the land laid down to permanent pasture. On 40 out of 50 acres of worthless grass, which had to be renovated and improved, he paid the cost of cultivating by steam, and allowed a half-year's rent and seeds; the tenant doing the acts of husbandry necessary for the proper preparation of the seed-bed. Strong clay-lands answer best for grazing. On light peaty soils the grass is comparatively worthless, whereas light lands, with plenty of rich vegetable soil, are most easily cultivated.

In this district more artificial grasses have been cultivated than formerly: it is not usual to let them remain more than one year, the five-course system being most generally adopted. With the aid of steam-cultivation occasionally, three horses have been dispensed with on the holding referred to. Improved

implements and better modes of cultivation have enabled me to make the labour-bill about the same as nine years ago, while the quantity of stock kept has been considerably increased. To graze artificial grasses through the summer gives the weeds a chance of germinating; then if the land is cultivated about harvest-time, it may be easily cleaned and left in an excellent state for wheat in the autumn—this method being in every way equal to a fallow.

About 40 acres of poor pasture having been steam-cultivated in the winter season by the landlord, the seed-bed was prepared by the tenant, and sown in the spring following rather late without a crop. The young seeds were nearly destroyed by the sun, having no shade: 18 acres produced nothing the first year; it was too light, hence it was thought best to cultivate it through a course of five years, and sow the seeds after a fallow. It is now a fair piece of grazing land, very much improved by the consumption of artificial food. Occasionally we mow some grass land, that which has the thinnest sward, the seeds from the hay having a tendency to improve it. Ten acres of worthless grass were broken up by plough or cultivator in winter, harrowed, made level and fine before the roots were killed, then rolled down with a heavy roller and sown with seeds in the spring. Land thus managed was much improved the first year, and the second it was superior to that beside it, that was not so treated.

Capital judiciously invested in the improvement of land in the way indicated, or the purchase of feeding-stuffs, manures, &c., will pay better than the old-fashioned systems. Liberal landlords, in whom the tenants have confidence, ensure good tenants, more capital invested, improved farms, together with increased produce. It should be the aim of leaders in agricultural matters to secure increased *produce*, rather than a superior class of animals to those we at present possess.

S. Egan.

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3. Clapham Park, Bedford.

Exclusive of woods and plantations, I farm 561 acres; it is my own property, with the exception of 160 acres, which I hold on a fifteen years' lease. It is all strong land on "Oxford clay" or "Boulder-clay." The rainfall is about 22 inches. I commenced laying down permanent grass in 1861, and have since—mainly for residential purposes—laid down about 160 acres, some with wheat, some after one year's dead fallow, and a smaller portion after two years' dead fallow, the latter proving far the best. I have tried close-drainage (20 feet) and drainage at wider intervals (11 yards), and find the former best; and I should recommend 8 yards apart, and 3 feet deep for grass land. Seeds are best sown without a crop. I have sown in spring, and in August or September; the latter is best, and less expensive, as vegetation is dormant, and the grasses cover the ground before the weeds begin to grow. The heavy and light seeds are sown separately, but simultaneously, one man following the other. I have tried the "inoculation" system most successfully. The preparation was the same; but strips were ploughed out of a good permanent pasture, and pieces about the size of the palm of the hand laid down about 9 inches asunder, the man treading upon each. Seeds were sown subsequently, and the whole rolled down. It is an expensive method, but a good pasture is much more quickly obtained. I would neither mow, nor depasture, new pastures; but fold in autumn, giving roots or artificial food, and the third year a good coating of farmyard-manure, repeating it as often as it can be spared. On the whole I have found laying down land of this character a losing practice, although, as the grass acquires maturity, more stock can be kept, especially young horned stock. For grass, I prefer good mild loam;

for arable, the strongest and the lightest. I have done nothing to artificial grasses on land that is still farmed as arable. For improving permanent grass, harrowing in autumn and spring, with a flexible spiked harrow, has had a good effect; also folding with sheep, giving them roots, &c.; as well as ground bones and farmyard-manure, the latter far the better; but for arable land I use artificial manures. I mow as little as possible and obtain hay from artificial grasses upon arable land. On the whole this result has been most satisfactory, and I think grass land pays for judicious outlay in improving it more quickly than arable.

James Howard.

4. Woburn Abbey, Bedford.

The extent of the present home-farm is 433 acres, together with the value of 200*l.* per annum on an open park (an agistment), all being property in hand. The nature of the soil is variable—one-third a poor sand—one-third a poor clay—and the remainder a medium loam. The rainfall is about 22 inches. We began laying down permanent grass in 1866, and have since completed 483 acres. The proportions of the farm were—arable land, 514 acres; sheep walk, 190 ditto. A portion of meadow land has since been added to open park land. This has been an experimental farm for many years, consequently there has been no change in the system of management. The greater portion was laid down with a crop of barley—a small portion without a crop—there was no opportunity of comparing the two systems. Moor-lands, I think, may be over-drained. Uplands for arable or pasture should be properly drained. We sow seeds all together in March. My predecessors used the following mixture, and it has been fairly successful to the present time, viz.:—

2 pecks of Perennial Rye-grass	per acre.
2 lbs. of Cocksfoot	
2 lbs. of Timothy.	
7 lbs. of White Clover.	
2 lbs. of Red Clover.	

Light land should be sown with a crop allowed to ripen. In autumn sowing a sprinkling of rape. In treating the young seeds, I would top-dress with soil, compost, or farmyard-manure; depasture with sheep, and run the mowing machine over the ground in September, if the grasses have run largely to seed. It is undesirable to depasture with heavy cattle, as they tread the ground too much. A few yearlings may be allowed to top the grasses. Although the system has not been in force long enough to say which pays best, the following items may lead to some conclusion:—

1865.	Labour	1578*l.*	Horses	14
1873.	Labour	637*l.*	Horses	6

Stock.

April, 1866.		1874.
Sheep, 1389	.. ..	1995
Cattle, 210	.. ..	172

Thus the breeding of sheep has increased, and that of cattle decreased.

C. Stephenson.

For the Duke of Bedford.

5. Brampton, Huntingdon.

I have in some instances laid down old arable fields with seeds for permanent pasture; bnt from my experience of these cases I should decidedly say that, as a general rnle, no occupying tenant can do so advantageously, as it will take a lifetime to make good old pastnre out of old arable land, and at such an expense as no tenant, even npon an ordinary lease, wonld enconnter. I think it much better, under the present circnmstances attaching to the labour-question, to extend the period allowed for artificial grasses on my arable land, and especially the more extensive cultivation of sainfoin. Sainfoin will keep well down for six years, thrives admirably on our clay-soils having a trace of chalk in the subsoil (which most of them have), and grows nearly double the weight of produce to any other artificial grass, snch as red and white clover, which we have long been in the habit of sowing; every kind of stock is fond of, and does well on, sainfoin. Its cnltivation is increasing rapidly, especially upon the high ridges of poor country dividing this connty from Bedford. On the Cotswold Hills the rise in the wages of the agricnltnral labonrer has not had much effect. A few farmers are trying the four- instead of the five-course system, which will rather increase the labonr of the farm, but not to the extent many think, there being considerably less work required to clean the land.

Peter Purvis.

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6. Patching Hall, Chelmsford.

I rent on lease, with the usual modern covenants for the county of Essex, abont 1000 acres of land, mostly clay or marl. The rainfall here, in Ongar and Epping district, is above the average of the rest of the connty. I commenced farming in 1854, and have laid down no more pasture; and should well consider before breaking any up. The proportions of my farms are:—arable land, 600 acres; meadow and pasture, 400. I have always farmed for making meat and rearing live stock. Land for pasture, I think, should be a retentive soil, not gravelly. The land should be in good condition; and my plan wonld be to sow grass and mixed seeds in summer or early autumn, after several plonghings. I pnt my drains further apart on pasture than arable land. Some pasture land is better for draining, but some is better left alone. I assisted my father to "inoculate" several acres, which answered well, bnt I should not attempt it in the present state of the labour-market. I believe it mnch better to mow the young crop the first time as soon as possible before the seeds get at all matured; the after-treatment is immaterial, so that sheep are not allowed to eat ont the clover and finer grasses too closely. The more manure the better. In short, it will scarcely answer the purpose of any tenant-farmer to lay down permanent pasture without the landlord's assistance, as after two or three years the produce decreases nnless the land is very well treated, and a good pastnre until after many years is the exception in this district. Therefore more stock can be kept by a succession of grasses, vetches, and roots, than on ordinary arable land. I have not found it difficult to improve old pastures, but would rather not make new ones as a matter of business.

David Christy.

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7. Woodham Lodge, Chelmsford.

I hold a lease for fourteen years on a farm of 403 acres, and have no tenant-right beyond the custom of the district. The soil is thin, on a subsoil of clay and loam; one field, however, is gravelly. My farm originally consisted

of 352 acres of arable, and 48 acres of meadow and pasture land. From 1863 to 1866 I converted 155 acres into permanent pasture or for a prolonged period of artificial grass. In changing my system of management I was influenced by the high price of stock and the increased cost of agricultural labour. I had a summer fallow the preceding year, and sowed the seeds with an ordinary white-straw crop. Deep thorough draining, superintended by Mr. Bailey Denton in 1861–2, has not helped as I expected. I have generally sown in March or April. A mixture of rye-grass, trefoil, and sainfoin was the most successful, the sainfoin being sown separately. The grain crop with which the seeds were sown was allowed to ripen. I have occasionally top-dressed with guano before mowing, but have generally depastured with sheep. I have not found this altered mode a success, and have converted nearly all into arable land again. I was enabled to keep more sheep and fewer cattle for a time. No aid was given me by my landlord in laying the land down to grass. Judging from the result of my experience, the best arable land will be the best for grass; but without tenant-right the tenant will be tempted to plough his grass land again towards the end of his lease.

James Youngman.

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8. Honingham Thorpe, Norwich.

I hold this farm of 420 acres (of which 40 are pasture) from year to year, and there is no tenant-right in the district. The soil varies from a stiff clay loam to a light gravel. The rainfall of this parish is about 23 inches. The climate of Norfolk is so dry, and the soil generally so light, that it is not likely much arable land will be turned into permanent pasture, unless something dreadful happens to the price of barley! I have no special rotation of cropping, but I take wheat and then barley after two years' seeds. I never keep common artificial grasses down more than two years; but sainfoin from two to four years. I find that increased pasture enables me to keep more feeding-sheep, especially in summer, and a larger flock of breeding-ewes. I have not diminished my horses to any extent, as I have recently hired a small adjoining farm, which requires any horses that I have to spare. Neither can I say that my labour is perceptibly diminished, for the men will not do the same amount of work as they did even a few years ago. When I mean to keep down seeds for two years, I omit red clover and trefoil from the mixture I use, and substitute cow-grass and white clover. By keeping artificial grasses for more than one year, there is certainly a tendency on light land to produce couch and other natural grasses. I keep my land clean by using the cultivator on the wheat-stubbles directly after harvest, and I continue to pull the root-weeds about until they are turned under an 8 or 9-inch furrow late in the autumn. By so doing I never have any cause to burn or remove any couch. In improving permanent pasture I find no dressing equal to a good coat of farmyard-manure, and I endeavour every alternate year to apply some manure or compost to it. I now grow my swedes and turnips entirely with artificial manure, and apply farmyard-manure to my mangolds. As I grow fewer acres of roots than formerly, I try to grow a greater weight per acre, and this I can best do by extending the cultivation of mangold wurtzel. I never mow any old pasture unless the seeds fail.

Clare Sewell Read.

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9. Barford, Warwick.

I farm for the owner about 400 acres of land, for the most part of a deep marl soil, some small portion having a gravel subsoil. The rainfall is uncer-

tain, but is considered above the average. I began laying down permanent grass in 1869, and have since completed 200 acres. Previously the proportions of the farm were:—Arable land, 300 acres; meadow, 28; permanent pasture, 70. I changed my system partly from believing stock to pay best, and my land being suitable, and partly from the labour question springing up; the quality of the soil, however, was the principal reason. I have found land do best for seeds after barley or oats. I should certainly say drain land for grazing. I have used Sutton's and Wheeler's mixtures with equal success. I sow both heavy and light seeds together, and harrow with light harrows. I have run a Cambridge roller over, then sown the seed, used light harrows after, and found it answer well. I would recommend seeds to be sown with corn, as I have known them to fail when sown without. I prefer grazing the first year, and no mowing, then one small dressing with farmyard-manure. Manuring is best done in the autumn after the corn is off. I can give no detailed accounts of the paying part of this mode of farming, but am sure that whoever lays down permanent pasture to any extent must make up his mind to lose for at least four or five years. We have increased our stock wonderfully, and can scarcely stock the land enough for the first three months, but I should say we generally keep about the same number, as it throws up great quantities of herbage. I think the better the land the sooner it becomes valuable for grazing; I have therefore kept our light soils for arable and root-growing purposes. I have increased the grass on my still arable land from one year to two or three, and I believe it rests the land, and saves considerably in horse and manual labour. In improving old permanent grass, I have found nothing to equal decorticated cotton-cake given to our sheep and beasts. I only mow meadow-land, and that every year. Winter floods keep it good enough. Some grass land, which was thought middling grass, I grazed beasts upon, giving them cake. Now it will feed beasts without cake; and as the price of beef is high, nothing pays better than feeding beasts, as there is no labour, or very little. Nothing, in my opinion, pays better than grazing, if a man is a good judge in buying his cattle, and lives near a good market to dispose of his beef.

R. Caulcutt.

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10. Weston Park, Shipston-on-Stour, Warwickshire.

As agent for Sir G. R. Philips, I farm 500 acres. Yearly tenancies are the rule in Warwickshire. A few of our principal tenants have leases, but in general farmers prefer yearly tenure, fearing revaluation at the close of the lease. A few estates concede payments for unexhausted purchased food and manures used during the later years of occupancy; and such payments encouraging continued higher cultivation are becoming more general. With us the landlord does the building, draining, roads, and new fences; the tenant the haulage, whilst occasionally a percentage is charged on outlay. In the southern division of Warwickshire half the land is permanent pasture, and has been for centuries, the lighter oolite soils towards Oxfordshire being more arable. Here seeds instead of remaining down one year remain several, and on the heavier soils during the last few years, on account of the increasing cost of labour, the area of permanent pasture has been extended. When the tenant finds the permanent seeds he may plough them up; when the landlord, he may insist on their continuing permanent. We were mainly led to the extension of permanent grass through the unsettled state of the labour-market, and the satisfactory returns from live stock. We select fields for permanent grass mainly on account of (1) nearness to the homestead, (2) being shaded by plantations, (3) liability to flooding. Some run the grass lands amongst the arable to facilitate the day and night transfer of sheep from

pasture to fallow. Land prepared for remunerative permanent grass must be thoroughly cleaned and liberally manured. Heavy clay should be fallowed, or cropped with vetches grazed by sheep; light land should be freed from weeds, and grown with roots, penned with sheep eating cake or corn. When one fallow fails to clean, another may follow immediately, or after a corn crop, the essential condition of success is that it be thoroughly clean and highly manured. Seeds thrive best where they have not been recently sown; often not for two years after beans, perhaps because beans abstract the lime of which clover is so fond. Grass land should be thoroughly and deeply drained. Though not so detrimental to grass as arable land, no land can be benefited by holding stagnant water, and getting rid of it by evaporation. I sow in March and April, the light and heavy seeds separately. A thin grain crop allowed to ripen does not injure young seeds, and in dry places and seasons affords shelter. I prefer it to rape, or corn eaten green, as the tender clover is injured by treading. I have only tried "inoculation" on a small scale, but think it advantageous in conjunction with the ordinary seeding-down. I have both mown and grazed seeds during their first autumn without detriment, but the practice is not generally advisable. Mowing highly manured grass does little injury if effected before the grasses are fully in flower. The best plan is depasturing with cattle liberally supplied with cake and corn. Even in localities with above an average of rain, the maximum return is not obtained for six or eight years, unless the land is very liberally treated. By extending the area in grass, the summer stock is increased—the winter diminished. The heavier soils, unfitted for the growth of roots, and situated in a moist climate, pay best in grass. Deep, friable loams, easily worked, fit for roots, and dry enough for the winter penning of sheep, are best for arable purposes. Grasses under rotation are now allowed to remain for two, three, or more years; sometimes until worn out. Land long under grass always fouls, especially when rye-grass is with the clovers. This is cleaned by extra autumn and spring cultivation; and in extreme cases by taking two consecutive root crops after one or two cereal crops. To improve permanent grass, extirpate moss by frequent harrowing in January and February, or by penning sheep constantly supplied with roots, chaff, cake, or corn. Top-dress with soil, town- or farm-manure, bones, or anything except sawdust. Salt and lime sweeten sour coarse herbage. Avoid poaching and heavy stocking during winter and early spring. Farmyard-manure taken for the grass is made up to the arable land by portable manures and the liberal use of cake and corn amongst sheep. I mow 100 acres of the same land every year; and prefer this to mowing and grazing alternately. I depasture with cattle, sheep, and horses, feeding-cattle and sheep being kept on the best land.

FINLAY DUN.

11. TWIGWORTH FARM, GLOUCESTER.

I rent 418 acres under a twenty-one years' lease, terminable on either side every seven years by one year's notice. My land is heavy cold clay, on blue-lias subsoil. We have about 25 inches rainfall. This last spring I commenced laying down permanent grass, and have laid down 20 acres. My farm consisted of 130 acres of arable land, and 288 acres of permanent pasture. I was induced to try the grass system by the great expense of working heavy clay, and the hope of an increase of good permanent grass for rearing dairy cows. I selected clean land in high manurial condition. This I did not especially prepare more than by previous crops of wheat, cabbage, and roots. Our clay cannot be made too dry for arable purposes, but may be for pasture. My land is well drained by pipes 20 to 30 feet apart. My high lands before draining

used to hold surface-water a yard wide. I was subsequently obliged to put drains between the 30-feet pipes, as the surface-water remained too long for the wheat plant. Were I to drain again, I should place the 30-feet pipes as deep as possible to cause the surface-water to penetrate as slowly as possible. I sow in the beginning of April, using Wheeler's mixture, the light seeds by hand, and the clover by seed-barrow, without a grain crop. In treating the young seeds, I propose to pasture with young cattle, and to manure the first winter with good manure and compost. Second spring I propose to top-dress with artificials mixed with fine earth or ashes. My landlord provided the seed on the condition that I should graze the first year with young cattle, and well manure the first winter. I prefer laying down my stiff heavy clay, keeping the light friable soil under the plough, my rotation being beans or vetches, cabbage, roots, mangolds, swedes, potatoes, wheat, with clover harrowed in in the spring. Old permanent grass is much improved by feeding cows, sheep, and pigs with cake, corn, roots, &c.; and by dressing with fine bones, superphosphate, ammoniacal manures, and yard-dung. I am obliged to mow 100 acres annually for winter keep. On the whole I am of opinion that nothing pays so well as the judicious improvement of grass land, as I find the number of head of stock has been increased year by year.

Let anyone who has a field of coarse innutritious grass, undrained, try the following: Drain with 2-inch pipes, 30 feet apart—4-feet deep if subsoil and outfall will allow. Harrow and cross-harrow, with sharp tines, in the end of February or beginning of March; top-dress with 3 cwt. of good superphosphate, 2 cwt. of guano, well mixed with ashes or compost, and applied with a manure-distributor. Sow good proportion of best renovating seed procurable, harrow with chain-harrow, and then roll; finish by 1st April. Feed off with young cattle in beginning of July; or, if dry weather, with sheep, hurdled, on cake in June. Give a good dressing of manure and compost in November or December—20 cartloads to acre.

COST.

		£	s.	d.
Cost per acre—	Seed	0	15	0
” ”	Drainage	6	0	0
” ”	Harrowing and rolling	0	15	0
” ”	Artificial Manures	2	6	0
” ”	Yard-manure, Compost, Ashes, &c.	4	10	0
		14	6	0

Now, say the field before improving was worth 1*l.* per acre, it will now be worth 2*l.*, or a permanent improvement of 1*l.* per annum for the expenditure —or a return of 7 per cent. for outlay.

The landlord should incur the whole expense of draining and seed, if improvement be done at commencement of 21 years' lease on improved rent or a proportion of half at expiration of lease, if done by the tenant at commencement of lease at old unimproved rent—as compensation to the tenant for permanent and unexhausted improvement.

WILLIAM T. DREW.

12. SIDDINGTON HOUSE, CIRENCESTER.

I have laid down a certain number of acres near my house, to have the luxury of looking on grass rather than upon fallows, but it has been done at a loss, even as regards the supply of food for stock, as well as the corn-crop. After the first two years, fresh laid-down pasture requires great assistance. I have used a great variety of manures, with more or less advantage. But

have found nothing so beneficial as manure fresh from the stables spread on the land, and, after it has been well washed with rain, I rake up the long straw which remains. I have broken up poor pasture with advantage—land which, when I did mow it (which was seldom) never produced more than 15 cwt. of hay to the acre in July. This land now produces every fourth year from 30 cwt. to 2 tons per acre of seed-hay, and every fourth year from 16 to 20 tons of roots per acre; so that I consider the supply of cattle-food is doubled, and I, of course, get a corn-crop every other year—4 to 5 quarters of wheat, and 5 to 6 quarters of barley per acre. The crops of everything are quite as good as when first broken up twenty years ago.

E. Bowly.

13. Chadbury, near Evesham.

I can only say in reply to the questions you have sent me as to the effect of the high price of live-stock and the increased cost of labour, that they have had none whatever in inducing the occupiers of farms, within my knowledge, to lay down their arable land, nor to alter, in any material degree, the management of their farms. Taking, for instance, a radius of 20 miles round Evesham the farms are mainly arable, and the first object is the production of wheat, for which both soil and climate are adapted. To this end as many sheep are kept as is practicable, with the twofold object of making mutton while preparing the land for wheat. Oil-cake and corn are given with the green crops, both in winter and summer, bare fallows being now unknown. The straw is made into manure by cattle also taking oil-cake or corn, and this goes to grow root-crops, aided by artificial manure. This has been the practice here for many years; and if the high price of meat has made any change, it is that rather more oil-cake and corn have been given, especially upon the grass land. There has been no such scarcity of labour as to raise the question of the necessity for laying down land for want of it. No doubt labour is more expensive, without, at present, the promised result that the men are to be more efficient by reason of their increased cost.

In laying down land to permanent pasture very much depends upon climate. Ours is not adapted to it, and the obtaining a moderately good turf is a slow process; while, as to leaving artificial grasses more than one year—the Cotswold Hills excepted—we know that we can grow a greater crop of wheat after one year's seeds than after two. So we go on as heretofore, very little affected in our management by the high price of stock or increased cost of labour, content to let the one square the other, and very glad if it covers the increase of rates also.

C. Randell.

14. Arley Castle, near Bewdley.

I have not kept my farming-accounts with anything like precision during the twenty-two years I have been proprietor of this estate (of now about 2940 acres). As far as my memory serves me, I think about 150 acres of this parish—rather more than less—have been converted from arable into pasture land, part having been in my own occupation, and part in my tenants'. The stiff or strong land has been found the most suitable for permanent grass. Tenant-farmers, as a class, are not sufficiently attentive to newly laid-down pasture land to bring it into perfection in a few years. Throughout this locality they have not sufficient capital to make the conversion of arable land into grass a favourite change to them; inasmuch as too many of them cannot afford to wait for the return which pasture land would give, and also

from the fact that grass land requires more capital to stock it than would suffice for corn-growing. Where I have found any tenant willing to lay down land, it has been my practice to pay for the permanent grass-seeds on his purchasing the needful clovers.

ROBERT WOODWARD.

15. WHITFIELD.

I farm, as agent to the Rev. Archer Clive, 1100 acres, which consist mostly of red loam for about 8 inches, then a subsoil of hard marl. Some portion consists of limestone substratum, and some parts of gravelly subsoil. I commenced laying down permanent grass about the year 1860, but not to any extent. Since then I have laid down 41 acres, the causes of my doing so being that it lay close to woods subject to much game, and that the soil was very thin. At that time I only farmed 800 acres, divided into arable land, 321 acres; meadow and permanent pasture, 479 acres. The 41 acres I cultivated under turnips. In my opinion, land for grazing should not be overdrained, but the springs should be taken away. I sow light and heavy seeds separately, about April, and have always left the selection to Messrs. Wheeler, of Gloucester, first having explained the nature of the soil. I sow without a grain crop, with a fair sprinkling of rape to hurdle the sheep on in autumn. I have usually dressed the land the second year with dissolved bones, or other grass-manure, and have allowed the seeds to get over-ripe, and mowed them to seed the land. In my opinion it is a bad plan to graze with sheep. Cattle and colts are much better. I find this mode of farming pays better than tillage, though in my case little was saved from horse labour, owing to the small quantity laid down. For several years I obtained little increase of stock, now it is improving yearly, and I have increased my sheep stock. Land in our district does not usually lay down well. On the arable land I find seeds do not pay to leave more than two years. My present rotation is (1) turnips or swedes, (2) barley or oats, (3) elover, (4) wheat; and if the land is in good condition, oats after wheat. I have increased my sheep and cattle stock, say, the sheep $7\frac{1}{2}$ per cent., and I rear 5 calves more yearly, though I do not think my profits have increased from laying down. This land does not easily get foul. I have done little to improve my grass lands. We are bad grass farmers in this district, and too far from towns to obtain manure. I usually mow the same fields every year.

THOMAS OLDAKER,
Agent to Rev. Archer Clive.

16. POULTON, CRICKLADE.

I rent on lease, without tenant-right, 297 acres—117 pasture, and 180 arable. The soil is Oxford clay, with the exception of 30 acres of cornbrash. Our average rainfall is 26·47 inches. I have not laid down permanent grass or changed my system of management. I think that grass land should be as thoroughly drained as arable. I drained, on taking my farm, all the pasture land requiring it, at, on an average, 18 yards apart, and have, since that time, on taking a new lease, put intermediate drains between those previously cut, which had for some time been less efficient, in consequence of the subsoil having become more compact.

With a view to improve pasture, I invariably give cake or corn to stock on grass. I have used both superphosphate and nitrate of soda on grass land, but have not derived such benefit from the application as would induce me to

continue the practice. Farmyard-dung, on the contrary, has always produced a marked effect, though put on at any time of the year. I have also used road-scrapings from oolite roads with great benefit to the character of the herbage. I have made no alteration in the quantity of farmyard-manure to my arable lands, which gets about 620 loads annually; but since covering my open cattleyards I have 576 loads to spare for the pasture instead of 300 as heretofore, a result of making manure under cover which I had not anticipated. I mow one-third of my grass land yearly. The remainder and the aftermath are depastured by cattle and horses till late in autumn, when the ewes come on and remain till February, getting chaff and pulped roots, and for the last six weeks or two months $\frac{1}{4}$ to $\frac{1}{2}$ lb. of cake or corn daily. I find my grass lands pay better than before. Thus, for three years (1863 to 1866), the average return from cattle was 320*l.*; from horses, 17*l*; and for the three years ending December 1874: cattle, 527*l.*; horses, 88*l.* In the first period, the average number of cattle kept was:—

Number of Cattle	41.	Value	479*l.*
Number of Horses	4.	Value	37*l.*

In the latter period:—

Number of Cattle	53.	Value	725*l.*
Number of Horses	8.	Value	138*l.*

H. J. Marshall.

17. Harberton, South Devon.

I rent on lease, in which there are compensation clauses for unexhausted manure, 240 acres of land of variable soil: some parts being on lime-rock with a dunstone surface; others, in the valley, black fen and clay; and other parts slate and white-acre, some very heavy, others very light. The climate is warm and humid. In 1867 I began to lay down permanent pasture, and of this new pasture I have now 20 acres. At that time my farm was composed of 156 acres of arable land, 10 acres meadow, 52 acres permanent pasture, and 22 acres marsh land, which has since been drained, broken up, and cropped with a view to its being relaid with artificial grasses of the best quality.

I found lime indispensable in this land. My first crop was ley oats, which was almost a total failure as far as grain was concerned. I then had a sample of the soil analyzed, and the chemist advised me it was rich in vegetable matter, but required time to decompose it, and that it would then grow good crops. The following summer it grew an excellent green crop, followed by wheat, which was equally good. One of these plots is now laid down to permanent grass, and I have no hesitation in saying its value is enhanced tenfold.

Another piece of ground sown to permanent pasture is a poor heavy clay, which somehow, what with expense of working and the uncertainty of growing fair crops, always brought me in debt. Aided by a few dressings of farmyard-dung, and irrigated by a small stream of water, this plot is doing well, and is a good run for cows and young cattle.

Among the reasons that induced me to lay down pasture, are—1st. The increasing demand and high price of animal food.

2nd. The increased price of labour, and the low price of wheat.

3rd. The uncertainty of growing good crops, and the quantity of rain we get in this district making the harvest uncertain.

The best preparation I have found for pasture grass seeds is to sow with barley after swedes; and if the soil is unsuitable for barley, the seeds should be sown without any other crop, the end of May or June, the ground pre-

viously having been well manured and cleaned. I do not approve of permanent seeds being sown with wheat, as the ground will get foul and carry an uneven face; nor do I like the practice of sowing rape with grass seeds, in order to fold off the rape, as the seeds are eaten too closely: this should be particularly avoided, and in order to strengthen the plant and prevent the cattle biting too closely, a dressing of good rotten dung should be applied in autumn, or in the following summer after the hay is carried.

I am of opinion that all wet land should be well drained, although possibly it will carry a worse face for a few years after, consequent on the water-weeds and grasses dying; and in the case of very poor herbage there is no process so effectual as cropping the land for a few years, and then relaying it to grass of the best quality.

As to my ordinary tillage land, I generally sow this to extra seeds or half pasture, which I purchase of Mr. Edwin Tucker of Ashburton, costing from 15*s*. to 18*s*. per acre. The soil being clean and the weather favourable, I sow my seeds in April; the light being brushed in with chain-harrows, and the heavy mixture being rolled according to soil,—grass seeds require a fine solid bed. All seeds should be mown the first year, when not over ripe; and, if a return is made to the field in the shape of good dung or other manure, mowing can do no harm, and in many cases is productive of much good, inasmuch as cattle are continually feeding on the sweetest and best grasses, and those of a coarser and poorer description are not allowed to predominate. By adopting this system, I am enabled to carry a much greater number of live stock, which will thrive and do much better on the pasture grasses than on ordinary seeds, such as ever, role, trefoil, and the like. Many of my fields managed in this way will fatten a bullock; and when I get them into a good grass-growing condition, I allow them to remain in grass five or six years, after which a succession of paying crops can be taken, with very little manure, and the labour is diminished, as a field that has grown a quantity of grass is both cleaner and more easily worked after the first ploughing than one that has grown but little.

After six years' ley, my cropping usually is ley wheat, mangolds, wheat, swedes, barley and seeds, or wheat, winter oats, vetches, turnips, barley and seeds. The cropping used to be, pare and burn for roots, wheat, barley and seeds for a two or three years' ley.

As to improving permanent pasture, I think it injurious to be continually stocking the land: it should be allowed at times to run into a good bite, and in early spring the whole of the previous summer grass should be eaten off as close as possible; then unstock until it is again fit to take cattle.

Folding with sheep on roots and cake will much improve pasture, but dung is better for fine herbage. For a coarse pasture I would recommend lime and soil and compost, or dissolved bones and nitrate of soda: 4 cwt. of bones and 1 or 2 cwt. of nitrate per acre. Coarse pasture can be improved by cutting, and manuring after the hay is carried. I use artificial manures largely for both roots and corn.

My personal experience of the system I have described is, that it requires about 30 per cent. more capital to farm successfully under it; and that a tenant requires a long lease and a good landlord to enable him to do justice to himself and his farm, otherwise the risk of leaving a great deal of his capital in the land, on a short notice to quit, is too great for most tenant farmers to run.

ALFRED TUCKER.

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18. THE DUFFRYN, NEWPORT, MONMOUTHSHIRE.

The larger portion of this neighbourhood is in permanent pasture. How long it has been so I cannot say, neither do I know whether the cause of its

being laid down was the high price of labour in years gone by or not; but labour in these mining districts has been at a high price for years. It has long been the custom hereabouts to sow mixed clovers and rye-grasses, and allow the land to remain a considerable time—sometimes six or seven years—in grass; then to break it up, crop for a few years, and then lay the land down again. This custom has prevailed to a considerable extent, and under present circumstances is sure to increase. No altered conditions have yet been sufficiently powerful to make any marked changes in our system. I formerly farmed nearly on the four-field system; but now, instead of clovers, I sow a mixture of rye-grass and Dutch clovers, and instead of breaking up after one year, I shall allow it to remain as long as it will produce a profitable growth, say three or four years. I have tried no other mixture of seeds, finding rye-grass, Dutch clover, and the natural grasses of the land, to answer very well; and this I believe is the general experience in these parts. On another farm, where sainfoin thrives, I have sown that plant, greatly preferring it to any mixture of grasses. This alteration of system has not been sufficiently long tried to enable me to give the pecuniary result; but my impression is that farming will not be less profitable under the altered system than it was before.

R. Stratton.

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19. Ciliau-wen, Fishguard, Pembrokeshire.

My farm is about 320 acres, of various kinds of soil, and is my own property. The average rainfall from 1849 to 1874 was 48·60 inches. I have laid down permanent grass for the last 18 or 20 years, and my whole farm, except 54 acres, is now under it. Its former proportions were—arable land, 6-12ths; meadow, 1-12th; permanent pastures, 5-12ths. I was not influenced by the labour question, as I had commenced laying down before the agitation began, but I always thought that dairy-produce with fat stock on fair land was more profitable than growing corn. In selecting my fields I avoided as much as possible all clay and yellow rab soil, preferring the southern aspect. I have always sown seeds with barley after turnips. I do not think draining essential, but have never found my drained land too dry. I sow both light and heavy seeds together in April. I have purchased mixed grass from seedsmen, but now sow, with satisfactory results, a mixture of Pacey's rye-grass, red and Dutch clover, Timothy-grass, and alsike, with a grain crop allowed to ripen. I have never tried "inoculation." I mow the first year, and graze afterwards. I am convinced that this mode of farming pays better, especially now that the cost of labour is so high, and the prices for dairy produce and fat stock are so fairly remunerative. I now let a large portion of my farm for grazing purposes, and find it carries a large quantity of stock. During the third year recently laid-down grass diminishes in quantity of herbage, after which it should be top-dressed and restored. I have improved my permanent grass principally by dissolved bones and compost. I have used lime, varying from 30 to 40 barrels per acre, on rich alluvial soil with marked advantage. I feed annually from 70 to 80 sheep on about 10 acres with turnips, corn, hay, and cake. I am obliged to use a greater quantity of artificial manure for cereals and green crops. I mow about 35 or 40 acres every year, but seldom mow the same land twice without top-dressing. I depasture the rest with cattle and sheep. My experience is that a judicious outlay will be repaid in two years, and the land improved considerably for another three or four years.

D. Evans.

Conclusion. By Morgan Evans.

It remains now to sum up the evidence contained in the foregoing interesting Reports; and although, on the whole, there is considerable unanimity of view, there are points on which great differences of opinion exist.

It appears to be the general practice of those who have laid down permanent pasture to select for the purpose the loamy retentive portions of the farm, and to continue the cultivation of the lighter, more easily worked barley-soils as arable land; but in a few instances light land, having a tendency to become thin by continual cropping, or from being on a hill-side difficult of cultivation, has been converted into permanent pasture. There are, however, many poor light soils that will grow under liberal treatment good green crops, and afterwards cereals, in the rotation, that cannot be converted by any reasonable amount of expenditure into good grass land. Under these circumstances, and where the land, as is frequently the case, differs greatly in character on the same farm, the better and more retentive soils appear to be the most desirable to lay down to permanent pasture.

There are three important points in the formation of new pastures; (1) the draining of the soil; (2) the mechanical preparation of the soil; and (3) the manure to be applied in the preparation of the seed-bed.

As to the first point, Colonel Rigg, Messrs. James Howard, J. Marshall, H. Browne, and W. Stewart, among others, maintain that grass land cannot be too thoroughly drained, and that it requires to be at least as well drained as arable land. On the other hand, Mr. J. Coleman does not "believe that grass land needs to be so uniformly dry as arable ground" (p. 460). Mr. C. Stephenson thinks moor-lands may be over-drained; whilst Mr. Egan is not in favour of drainage, being confident that much land in his district "has considerably deteriorated in value by too much drainage" (p. 485). Where views so directly opposed to each other are entertained by experienced men, it may appear presumptuous to decide between them. On the whole, I am inclined to believe that grass land does not require to be drained as thoroughly as arable land, and that it may even be possible in light porous soils in a dry climate to over-drain the land. Although in corn-land any excess of moisture which is unfavourable to the particular cereal sown is a direct loss to the only plant which exists at the time, and on which the success of the cultivation depends, a comparatively wet soil under grass is not precisely in the same predicament, for all grass is not one grass. Some grasses flourish in damp soils; and although the

majority of these are of a coarse kind, yet many of them afford excellent food for stock; and there is no deficiency of bulk, at least, considered as grass, should the soil not be thoroughly drained. Of course, there should be no stagnant water either in the soil or on its surface. But inasmuch as it is acknowledged that a humid climate and a large rainfall are the most favourable conditions for the growth of grass, it does appear reasonable, even if experience did not also confirm the idea, that a somewhat damp soil is not objectionable for pasture-lands, and that the drainage need not be so perfect as where the more delicate cereal crops are grown. And as close and deep drainage is such an expensive operation, it is necessary to show a decided advantage from the operation before one could well advise in any instance the investment of so large an amount of labour and capital as it requires, and this does not appear to be satisfactorily demonstrated in the evidence given in the preceding pages.

As it is essential that the land should be thoroughly cleaned before it is laid down to permanent pasture, either a bare summer fallow or a green crop fallow should immediately precede the seeding of the land. The preparatory cultivation will depend upon the character of the soil and the difficulty of making it sufficiently clean for the reception of the seed. In most cases, where the land is in a previously good condition, a crop of turnips well attended to during the summer months is all that is required. A bare summer-fallow well worked is the course adopted by many. Several witnesses, however, recommend two turnip-crops as the best preparation; and in a few instances two white crops have been taken before turnips. No hard-and-fast line can be drawn. The natural mechanical condition of the soil, its disposition to become foul by weeds, and other circumstances, account for the variable methods pursued. Two white crops before turnips in some instances may be advisable to leaven the soil, and to enable it to be more thoroughly cleaned, by the harrow and cultivator bringing to the surface the tangled roots of couch and other grass-weeds where they are prevalent. It may be said these should not exist at all; but the difficulty of ridding some land of them is well known. Even a fallow of any sort presupposes the necessity of the land being clean, as much as its having a suitable mechanical texture. Mr. Toppin is enabled to sow down to grass in July, directly after a corn-crop in the preceding year, the corn-crop having been grown after lea. And after trying different modes of preparing the land he finds that this has answered the best (p. 458). Mr. Toppin finds such a preparation all-sufficient, and he must consider himself fortunate, as in the majority of cases such treatment would be worse than useless. There is no reason, however, to question

the result of his experience. It only serves to show how greatly soil, climate, and local conditions differ. But, putting aside extreme cases, it appears that for the generality of soils a bare fallow or a green crop is a necessary preparation.

A turnip-crop consumed on the land is a good method of obtaining the necessary manurial condition, especially if cake and corn are also given to the stock. The turnips should be grown with a liberal dressing of manure, consisting of farmyard-manure as well as artificial, if possible. Light land is especially benefited by feeding with sheep. On heavy land, where a bare fallow is deemed advisable, a good dressing of bones or superphosphate, or a mixture of artificial manures, should be applied to the land when sown down. A few of the witnesses also recommend the use of lime, which is, no doubt, necessary on many soils. Considerable differences of opinion exist as to whether the seeds should be sown down with or without a crop of corn. The objection to sowing with a corn-crop is principally the risk of the corn lodging, and so killing the grasses, as the land is generally more highly manured when prepared for permanent pasture than when seeds are sown in the usual rotation. Sowing with a sprinkling of rape is a common practice, the rape to be eaten off green with sheep, and this appears to answer well in the majority of cases. Care, however, should be taken not to eat off too closely, or the young grasses may suffer, and on light soils many of the plants may be pulled completely out of the ground by the grazing sheep. Few of our correspondents appear to sow the seeds alone, except those who advocate autumn sowing. Mr. James Howard, among others, practises this system. He says, "I have sown in spring, and in August and September; the latter is best, and less expensive, as vegetation is dormant, and the grasses cover the ground before the weeds begin to grow" (p. 486). There is a risk, however, attending autumn sowing, as the young clover is liable to be greatly damaged by slugs and the winter frost. If sown alone in the spring, and a hot dry summer follows, there is, again, a probability of the grasses being almost completely destroyed by drought. It is certainly an advantage if any kind of crop can be grown simultaneously with the grasses in their first season, if the practice is not detrimental to the capabilities of the future pasture; and most farmers would find it more convenient, if not more profitable, that that crop should be corn. A thin sowing of barley, oats, or wheat, is therefore strongly recommended by many. The seeds appear to do almost equally well sown with the spring-corn, or sown in the spring on autumn-wheat. Mr. Martin H. Sutton* says that oats

* 'Journal of the Royal Agricultural Society,' vol. xxii., part ii.

are less injurious to grass than barley. But all the gentlemen who have reported on their systems, and who sow the grass-seeds with spring-corn, mention barley as the crop they cultivate in such cases. No doubt, this again generally arises from a desire to follow without interruption their usual system of barley-growing after turnips; so that there is a general inclination to sow seeds in the usual crop, and in the usual way adopted in the ordinary four-course system. It is unnecessary to deviate from this, if it can be shown that it answers equally well for the more permanent as well as for the artificial grasses. It is no slight advantage, under the circumstances, to be able to grow the customary crop, and the one which is found to pay best, and at the same time to prepare for a permanent pasture. And as seeds usually do well in the ordinary rotation, why should they not do equally well when intended to remain permanent occupants of the soil? Diversity of soil and climate, however, account for much diversity of opinion and experience. And perhaps the relative advantages of the two systems, and a correct estimate of their merits, are well exemplified in the remarks of Mr. John Coleman, who says, "In a climate so dry as ours (our rainfall averaging only about 26 inches) we consider that the grain-crop is invaluable as a shade to the young seeds. With a more humid atmosphere, I should be inclined to sow down with rape" (p. 459). Mr. Carter, who has tried both plans, says that, "provided the land be in good heart, clean condition, and a proper seed-bed has been secured—three essential conditions—it does not much matter which of the three methods be used" (p. 470.)

There is little comment necessary on the mixture of seeds used by the various correspondents. These are of the usual kind recommended by seedsmen, and will vary according to their natural adaptation to the soil of the district. Timothy and alsike appear to be increasing in popularity. These, along with the fescues, white clover, rye-grass, &c., are the principal constituents. It may be remarked, however, that the quantity of grass-seeds sown per acre appears to be much larger than was formerly considered sufficient for the purpose, and this for good and sufficient reasons. Cereal crops, where the maturity of grain is the great object, may be sown too thickly. But abundance of leaf, not seed, is the prime requisite in artificial grasses grown for pasture.

The month of April is the time commonly chosen for spring-sowing. Mr. Carter sows at the end of March when the weather is propitious. A few sow at the end of April or beginning of May. "Upon autumn-sown wheat," says Mr. M. H. Sutton, "the grass-seeds might be sown as early as the middle of

February if the weather be open, as the wheat will defend the young grass from any injury by frost; but if the wheat is very backward, or stands thin on the ground, the sowing may with advantage be deferred." In very wet climates some of the small delicate seeds are liable to perish if sown as early as February. When they have to be sown on autumn-wheat, however, the time most suitable will sometimes depend on the forwardness of the wheat-plant, as the operation should not be deferred after that is 3 inches high. April is, on the whole, the safest month, when the weather is more genial than earlier in the year, and the risk of drought is not so great as at the commencement of the summer season. The light and heavy seeds are sown either together or separately. The only point to be regarded is that they be evenly distributed. A proficient sower may sow them mixed and at one operation. The safest method is, perhaps, to sow them separately, one man following the other, as adopted by Mr. James Howard; or if both the light and heavy seeds be mixed, one-half can be sown in one direction, and the remainder the reverse way, or across the ridges. A good plan of distribution is for the sower to increase the quantity of land by half the width commanded by his hand each time he goes along the field, which is, in reality, sowing half the seeds at a time. Thus, if sowing a 12-foot ridge, he would sow from back to back, and from furrow to furrow alternately. In this way any tendency to throw the seed thicker to the right or left hand would be corrected, for each half-ridge would be treated to the same kind of sowing. Many persons sow the light seeds by hand, and the heavy by barrow. Whatever system is adopted matters little so long as an even distribution of seed is secured. After the seeds are sown, they should be covered by a light harrow, or a brush or chain-harrow, and rolled down to give an even surface to the land.

Few correspondents have given an estimate of the cost per acre of laying land down to permanent pasture. When draining and summer-fallowing are necessary preparations, and the seeds are sown without a crop, the expense must be very considerable. On some lands, naturally clean and easily worked, the outlay is not greatly in excess of the usual expenditure for artificial grasses in the rotation, and is only increased by the additional quantity of manure applied, and the extra cost of the mixtures for permanent grass, the latter, according to Mr. Alfred Tucker, being at the rate of 15*s*. to 18*s*. per acre. Mr. Outhwaite estimates his total outlay at 10*l*. per acre, which amount, he says, does not include the cost of seeds, which were provided by his landlord. Upon what particular items this expense has been incurred he does not say; but he states that

he sows the seeds without a crop in the middle of July, and applies at the same time 15 cwt. of bones per acre. The estimate appears to be excessive, unless there are some special features in his process not fully explained in his communication. Where drainage must be undertaken and summer-fallows difficult of cultivation must be worked, it is easy to see how even a greater expense may have to be incurred; under ordinary circumstances, it should not cost so much. What it should cost depends chiefly on the character of the soil; and the most costly process is not necessarily the best in all cases.

The proper after-treatment of seeds is not less important than the thorough preparation of the land for their reception, and the conditions under which they are sown. There is a want of unanimity of opinion here as elsewhere amongst the correspondents. Most of them advocate mowing in the first season. Of these, again, the majority prefer mowing early or before the grasses have ripened, whilst a few leave them to get fully ripe, with a view partly to the re-seeding of the ground. There is no doubt that the grasses, having grown to full size previous to mowing, develop a stronger root-growth. If not mown early, however, there is a probability that the larger, stronger plants may outgrow and injure those of a finer character. The plan recommended by Mr. Martin Sutton is to mow twice during the first year, the first time as early as possible, maintaining that "this frequent cutting checks the stronger grasses, and affords the more slender-growing kinds a better chance, and all are encouraged to tiller out and form a close sward." Depasturing with sheep the first season is recommended by several, but almost always accompanied with a caution not to graze the land too bare. Sheep are inclined to eat the grasses too closely, and therefore several gentlemen (one would think very properly) prefer stocking the ground with young cattle, with the addition, in some cases, of horses. Possibly grazing with mixed stock—a run with sheep (young lambs in preference to those of an older age), alternately with cattle and colts, may be safely recommended in the majority of cases. For the different kinds of stock having different tastes, one class of animals will consume those grasses rejected, or at least neglected, by the others, and prevent the patchy appearance common when only one kind of stock is depastured. When the pasture, in succeeding years, has become well-established it matters little what animals graze it, as long as it is liberally treated with manures to keep it in an uniformly good condition, if not to rapidly improve it.

It would seem advisable, especially on light soil, to roll the seeds with a heavy roller in the autumn of the first year, for, as Mr. John Coleman remarks, "much of the failure of clover is

due to mechanical condition." In reference to this period of the year and stage of growth, he also adds: "No stock should be allowed on unless the seeds be very big, and then only light mouths, as lambs and calves, should be run over. If a light coat of foldyard-manure can be spared, the same may be applied in winter and carefully spread; but, as the lumps of manure are often injurious to the delicate seeds, I prefer an artificial dressing, such as soluble phosphate, potash, and ammoniacal salts, applied in spring" (p. 459). This advice may be considered sound and practical at all points. If the land is in good heart by previous manuring and preparation, and the seed-plants abundant, it would appear unnecessary to manure in the autumn of the first year; whilst a top-dressing with artificial manures in the spring is easily applied, and promotes a rapid, strong growth of grass, either for hay or for grazing with young stock, such as will well repay the outlay. Presuming then that by this means a good crop is produced during the summer, henceforward the land requires great attention to prevent the artificial grasses from gradually disappearing before the natural grasses are established. A heavy dressing of farmyard-manure or compost is generally recommended in the fall of the year, and the application of bones, ground or dissolved, or of a mixture of potash salts and nitrogenous manures during the next few years, as occasion may require. Mr. Sample so well prepares his land, and lays it down in such good heart, that he has not found that "any assistance was needed for five or six years" (p. 462). So much depends upon the preparation of the soil, its retentive character, and its natural tendency to run into grass, that no fixed rule is applicable in all cases. But it is generally necessary, as well as advantageous, to treat the land liberally with farmyard and other manures frequently during the extended period in which Mr. Sample finds it do sufficiently well without any attention whatever. The majority of the witnesses, in accordance with the experience of most farmers in almost all districts, consider that the critical period commences after the second or third year; and it is at this time that the artificial grasses should be refreshed with manure, and the growth of natural grasses encouraged by the same means.

The consumption of artificial foods on the land by the grazing stock is one of the most effectual means of manuring the soil. In accordance with the teaching of the chemist, the manure derived from decorticated cotton-cake proves to be of high value, and feeding cattle and sheep with this substance on grass land is highly recommended by several. In improving permanent grass Mr. Caulcutt finds "nothing to equal decorticated cotton-cake given to our sheep and beasts" (p. 490). On good soils

the consumption of artificial food on the ground by the grazing stock will be sufficient to secure a gradual improvement of the grass. If a more rapid improvement is desired, an occasional top-dressing with artificial manures, alternating with bones, lime, compost, or farmyard-manure, should be applied. At all times it is to be presumed that manuring grass land with suitable substances will repay the outlay. There is little danger of being too liberal in this respect, although some grass land will yield a fair profit by grazing alone, and the inducement to give it additional manure is not so great. Corn crops may be too heavily manured, leading in moist seasons to a great yield of straw at the expense of quality of grain. Barley or wheat may be too bulky and get laid, when the grain does not properly ripen, and the difficulty and expense of harvesting the crop are considerably increased. But grass being consumed in the blade, and before it is ripened, cannot well grow too luxuriantly. *Cæteris paribus*, the outlay in manuring grass is a safer investment than in the case of corn.

The great value of farmyard-manure as an application to grass land, both young and old, appears to be admitted by all. There is no difference of opinion on this matter. Whilst abundant corn-crops can be raised by artificial manures alone for a series of years, grass appears to require for its highest development occasional dressings of farmyard-manure. This was pointed out by Mr. Lawes, many years ago, in this 'Journal.'* The soil under grass has not the same chance of getting its mineral constituents liberated as when cultivated for corn, and these are likely to become practically exhausted by the forcing process of frequent applications of nitrogenous manures, especially if the land is mown for hay. The permanent condition of grass land is most improved by farmyard-manure and the consumption of artificial food on the ground. Although, however, the continual use of nitrogenous and phosphatic manures is likely to diminish largely the available alkalies, alkaline earths, and silica in the soil when the grass is annually mown, the same amount of loss does not accrue when it is grazed. The more active and forcing manures, creating a more luxuriant growth, will enable a larger quantity of stock to be kept upon it; and if these, at the same time, are properly supplied with artificial food, there will be a rapid direct improvement of the pasture. The interesting Rothamsted experiments showed that nitrogenous manures increased largely the graminaceous plants (natural grasses), and mineral manures the leguminous (perennial red clover, &c.); whilst farmyard-manure gave "a more complex and generally superior character of herbage." And the conclusions drawn

* Vols. xix. and xxiv.

from these experiments, as far as farmyard-manure is concerned, are singularly in accordance with the opinions of practical agriculturists, as shown by the foregoing letters.

There is not the same general agreement as to the value of lime and bones as in reference to farmyard-manure, and this is just what might have been expected on scientific grounds as well as from practical experience on the varied soils of the kingdom. Thus Mr. J. C. Toppin says, "lime I tried with no effect" (p. 458); Mr. G. A. Gray, "I never saw any good from bones on the surface" (p. 463); Mr. J. Shuker, "I must confess that bones have not had so much effect as I looked for" (p. 468); and Mr. John Hemsley, "lime and bones are of undoubted benefit upon many pastures, but even these cannot be applied indiscriminately; I have used both on some soils without being able to see the slightest effect" (p. 477). Mr. Lawes has indeed said,* "The application of bones is not recommended for general adoption. They appear to be chiefly adapted to the exhausted pastures of certain localities." Judging, however, from the foregoing communications, we shall perhaps be more correct in saying that lime and bones might be generally recommended, but that there are exceptions to the rule, and that on many soils they are of little or no effect in improving the quality or quantity of the herbage.

Dr. Augustus Voelcker, in his recent able paper on "Field Experiments on Permanent Pasture,"† has shown that on some soils bone-dust is inefficacious as a manure for permanent pasture, and that there are both light and heavy pastures on which lime has no effect whatever. There is no pasture, however, he says, "the productiveness of which may not be largely increased by a heavy dressing of farmyard-manure, or by a top-dressing of guano, or by artificial mixtures composed of ammonia-salts or nitrate of soda and superphosphate of lime." His opinion is strongly corroborated by the foregoing reports.

In the application of artificial manures as a top-dressing to grass, the most important elements necessary are nitrogen, phosphoric acid, and potash. The first is most readily supplied in nitrate of soda, ammoniacal salts, or Peruvian guano; the second in superphosphate of lime, and the last in Kainit. These may be regulated according to will, depending on the nature of the soil. Mr. H. S. Thompson, in his paper on the "Management of Grass Land,"‡ recommends 1 cwt. nitrate of soda, 2 cwt. of mineral superphosphate, and 3 cwt. of Kainit per acre. Mr. John Coleman applies a less nitrogenous mixture, viz., 3 cwt. bone phosphate, 1 cwt. Kainit, ½ cwt. nitrate of soda (p. 460). Mr.

* 'Journal of the Royal Agricultural Society,' vol. xix., p. 573.
† Ibid., 2nd Series, vol. x., part ii. ‡ Ibid., 2nd Series, vol. viii., part i.

Lawes, on the authority of Mr. H. S. Thompson, recommended, in a certain instance, $1\frac{1}{4}$ cwt. nitrate of soda, $2\frac{1}{2}$ cwt. superphosphate, and 3 cwt. Kainit, as a renovating mixture for old grass land. The same proportions will not suit all places alike. The farmer must be guided in his selection by his own knowledge of the requirements of his soil, or by experiment and experience.

There is no doubt that of artificial manures the most highly nitrogenous are the most generally efficacious as top-dressings to grass land, and that farmyard-manure is the most permanent and beneficial in improving its condition. Mr. Lawes, therefore, in a letter which I have just received, says, "I am disposed to think a dressing of dung once in five years, and 2 cwt. of nitrate of soda the other four, is about as good an application as can be used;" adding, "you may be sure that the production of pasture is a most costly operation, and it takes a lifetime to convert arable land into pasture."

The latter remark is borne out by several of our correspondents. It appears too true, according to experience in many localities. But the task of converting arable land into pasture is not everywhere so discouraging. The operation is certainly costly, and it takes a long time before repayment commences. But in moist climates on quick fertile alluvial soils, or on those resting on carboniferous or mountain limestone, or red sandstone, a fresh good pasture may be made in a comparatively short time with proper care and attention. On sandy or chalky soils, and on poor strong clays, the case is different, and the work is one of considerable time and labour. Indeed, on all poor soils it is difficult to form a good pasture. It will be found more profitable to keep these under the plough, as they will occasionally throw a fair crop of roots, which, if eaten on the land, will be followed by a fair crop of corn.

"Occasionally," says Mr. Egan, "we mow some grass land, that which has the thinnest sward, the seeds from the hay having a tendency to improve it" (p. 486). The improvement probably is not entirely due to the seeding of the land. The continual grazing or continual mowing of grass produces a special character of herbage, and I have both seen and experienced the best results from mowing for two or three successive years old grass land, and the grazing for a similar period meadow land which had been annually mown for a long series of years. Many of the coarse grasses and weeds peculiar to fields annually mown are destroyed by a few years' grazing, and the weeds that will sometimes infest grazing pastures are likewise destroyed by mowing, and the patchy appearance of the fields corrected. A somewhat corroborative testimony on this point is afforded by Mr. J. Archer, who says, "if in spite of the artificials consumed by

stock on a pasture I find it is not grazing well, I apply a little salt, manure it, and mow for a year or two, which quite changes the herbage and improves the field immensely" (p. 474).

The conversion of arable land into permanent pasture by "inoculation" is rarely practised. It would naturally appear to be an expensive system, as stated by Mr. James Howard, and to do best in a moist climate where land has a tendency to run into grass. Mr. Hodgson Huntley states the cost in his case to be only 1*l.* per acre, exclusive of horses and drivers (p. 464). But this clearly is but a small portion of the expense, as some considerable allowance must also be made for the damage done by the removal of the strips of turf from other quarters, unless it is to be understood that the land from which these are taken is in course of being broken up.

Those persons who have answered the questions referring to an altered system of rotation and an extension of the period for artificial grasses, are but few; but they are favourable to the system, as increasing the grass-producing area of their farms, and consequently enabling them to keep more stock. It is generally admitted that land left for two or more years in grass has a tendency to become foul, and is at least not so clean as one year's grass when broken up for wheat or any other crop in the rotation. This difficulty, however, is not insuperable. Mr. C. S. Read says, "by keeping artificial grasses more than one year, there is certainly a tendency on light land to produce couch and other natural grasses. I keep my land clean by using the cultivator on the wheat stubbles directly after harvest, and I continue to pull the root-weeds about until they are turned under an 8 or 9-inch furrow late in the autumn. By so doing I never have any cause to burn or remove any couch" (p. 489). Admiral Eliott says, "The land does, I find, become more foul under this practice; but a deep ploughing, though it may cost an additional 10*s.* per acre, cleans it effectually."

It is certainly unadvisable, in the present state of prices of agricultural produce and labour, to break up any tolerably good pastures for the purpose of converting them into arable land. Pastures worth not less than 30*s.* per acre had better not be ploughed up, but should rather be improved by manuring, and made to produce grass in greater quantity and of a better quality. The production of "corn for the million," as it is called, is not so important just now as the production of meat. Even if it were, from public or national considerations, more desirable to grow corn than to feed stock, it is difficult to see why the farmer, more than any other class of individuals, should sacrifice his pocket to his patriotism. He cannot be supposed to follow his business solely with the aim of supplying the

country with any special article of food, when the production of another kind costs him less in labour, time, and money, and is withal more remunerative to him.

It appears evident that more meat can be produced at a cheaper rate on pasture land than on arable, and that investment in stock is more safe than in the cultivation of corn. Almost without exception do the reports favour this conclusion. The increase of stock has been great in most instances, whilst the expense attending the keeping of cattle and sheep is much less than that of the cultivation of corn crops. The labour bill is considerably diminished by converting the land into pasture—no small advantage in the present age of strikes. One of our correspondents saves 200*l.* per annum in this way, although he apprehends his gross returns are now somewhat less than formerly. His profit on capital, we presume, is largely increased, and this is the chief object with the farmer as with everyone else.

Although the series of questions put to our correspondents contained a particular request for "a tabulated comparison of the two systems (arable and pasture farming), including the saving in manual labour and in horse-keep," in no single instance has there been a full and satisfactory reply on these points. Sufficient, however, may be gleaned from a perusal of the foregoing communications to prove the decided advantages in these respects of pasture over arable land. The evidence all tends to prove that a greater number of live-stock can be kept on pasture than on arable land, that the profits are more direct from grazing cattle and sheep than from growing corn, while the expenses are much less.*

With these brief remarks I leave the further consideration of the subject to those readers of this Journal interested in a new and important agricultural movement. It is not necessary for me to analyse more minutely the mass of correspondence received by Mr. Bowstead and myself in answer to our inquiries; nor is it my duty to give more definite expression to my own personal opinion on the laying down of land to permanent pasture. Practical men will be able to digest the preceding reports in their own fashion, and to utilise the information they contain in the way that will best suit their purpose.

* On this point see also Mr. Bowen Jones's 'Report on the Somersetshire Farm-Prize Competition,' *infrà*, p. 595.

XIX.—*Report on the Health of Animals of the Farm.* By Professor J. B. Simonds, Principal of the Royal Veterinary College, and Consulting Veterinary Surgeon to the Society.

In the last Report of the College 'On the Health of Animals of the Farm,' which was brought down to the end of the past year, attention was drawn to the circumstance that no unusual amount of disease due to common causes had prevailed among cattle and sheep. This remark may now be repeated, as being equally applicable to the first half of the present year. On the contrary, since January, special diseases, and notably those which come under the ordinary designation of epizöotics, have been very rife.

With respect, first, to the most common of these maladies, "foot-and-mouth disease," the reports which have come to hand would seem to show that this malady has varied but little, and that it is as wide-spread now (July) as it has been at any time during the past winter. Its malignancy, however, would seem to have been somewhat abated, as we have heard of fewer deaths, excepting in cases where ordinary sanitary precautions had been neglected, or where excessive dosing of animals with medicine had been adopted. Secondary attacks have also been less frequent, than which there are few better proofs of the disease having assumed a milder type.

Speaking in general terms, the disease may be said to have prevailed over the whole of Great Britain; but it has nevertheless been asserted on good authority that Ireland has escaped an outbreak of the malady. If this be correct, of which we have considerable doubt, the fact is the more remarkable, when the wide diffusion of "foot-and-mouth disease" on the Continent is considered. According to the latest information, both Spain and Italy have now to be added to the list of infected countries. The returns from the Veterinary Department of the Privy Council Office also show, that week by week diseased cattle, sheep, and pigs, have during the last six months been landed at our ports from Belgium, France, Holland, and Germany, and also now and then from Denmark and Sweden. The diseased animals, and those which were brought in the same vessels with them, have been dealt with according to the provisions of the law, and slaughtered at the port of landing.*

* In the interval between the writing of this Report and its publication, "foot-and-mouth-disease" assumed a very serious form, and attacked large numbers of sheep and pigs as well as cattle over the greater part of England. Its existence also in Ireland was fully established.

With a *contagium* so subtle as that which belongs to "foot-and-mouth disease," and on which its extension depends, it is to be feared that the country will never enjoy immunity from periodic outbreaks of the disease in a serious form. The painful experience of thirty-six years is a sufficient warrant for this opinion. Restrictions on the movement of animals; isolation of the diseased; free use of disinfectants; and strict veterinary inspection of all fairs, markets, and cattle exhibitions, would no doubt be attended with beneficial results. We adhere, however, to the opinion so often expressed, that to free the country of "foot-and-mouth disease," regulations similar to those which were enforced during the prevalence of cattle-plague are required; but the adoption of these in the present state of public opinion must be considered altogether impracticable.

Pleuro-pneumonia.—This malady has varied but little in the number of centres of its existence during the past six months. According to the latest returns it prevailed to a greater or less extent in forty-one counties of Great Britain, being, however, very irregularly distributed. Thus, for example, the South-Western counties of England have been nearly free from the disease, as also the greater part of Wales; and with the exception of the South and South-eastern portions of Scotland, very few cases of pleuro-pneumonia have existed in that country. This circumstance may in part be explained by the fact that the counties in which the malady persists are importing rather than exporting ones of cattle.

On the Continent pleuro-pneumonia has prevailed rather extensively, more especially in the Netherlands. At the present time, however, the reports which reach us from Holland are more favourable, it having been found that the disease has declined under the system of inspection, isolation, and registration of suspected herds, and the slaughter of diseased animals. A knowledge of the laws which govern the spread of the disease has led to the adoption of these preventive means, and there can be no doubt that wherever they are strictly enforced benefit will arise.

From the experiments which have been instituted by ourselves, and which have been reported *in extenso* in former volumes of this 'Journal,' it may be safely concluded that the extension of pleuro-pneumonia from diseased to healthy cattle depends on cohabitation, and consequently that perfect isolation offers the most effectual barrier to its spread. We not only have no confidence in curative measures in dealing with pleuro-pneumonia; but believe that in proportion as they are had recourse to they are likely to prove prejudicial to the interests of the agricultural community. Centres of contagion are thus kept active; besides which, animals which rally from the attack remain *foci* of in-

fection for a long and indefinite period, and cannot consequently be safely herded with those which are healthy.

Cattle-plague.—Since the beginning of the year this fearful malady has produced serious losses among the cattle in Illyria, Austria, Galicia, Poland, and contiguous countries. Hungary, however, is reported to have escaped the introduction of the pest. Early in the year the disease crossed the Polish frontier and entered East Prussia, but was very quickly exterminated. An official inquiry into the circumstance failed to show the means by which the disease had been introduced. The malady also extended at that time to Saxony, but was speedily stamped out by the sacrifice of a very few animals.

In April some alarm was created here by reports that the cattle-plague had broken out in Holland, which, however, was soon allayed by official contradiction. The latest intelligence, however, of the spread of the disease in Eastern Europe is not very encouraging, especially so far as Germany is concerned, as a very virulent and extensive outbreak of the disease in the Russian provinces adjacent to East Prussia is reported to have taken place.

Typhoid fever in Pigs.—In the Report for the latter half of last year it was stated that several cases of this disease had occurred in different parts of the country, and notably in Somersetshire. Recently we have ascertained that the malady still continues in the Western counties, and that large numbers of pigs, the subjects of typhoid fever, have died in Monmouthshire, especially near Abergavenny.

This outbreak of typhoid fever has been made the subject of a special investigation; and among several new and valuable experiments to determine the pathological characters of the disease, the following have been instituted by Professor Axe:—

Two healthy pigs were placed in a stable in which a diseased one was confined, and secured in such a manner as to prevent the possibility of contact between them and the diseased animal. The stable was kept locked and no one allowed to go into it except in the presence of Mr. Axe, who superintended the feeding and management of the animals, as daily required. On the morning of the third day—a little more than forty-eight hours after exposure of the healthy pigs to the infection—the diseased one was removed and killed.

The experimental pigs were still kept strictly isolated and carefully watched. On the *fifth* day after the exposure, one of them gave indications of ill-health, and on the *seventh* day the other also was unwell. Typhoid fever gradually developed itself in both, and on May 13th one pig died, and the other on the 18th. The *post-mortem* examination which was made in each case revealed all the ordinary lesions of typhoid fever.

During the progress of the disease, a well-marked cutaneous eruption took place, and was followed with the formation of vesicles. These yielded a fluid which was collected on ivory points for inoculation, and with it *two healthy pigs were inoculated.* They both contracted typhoid fever; the one sickening on the *fifth* and the other on the *sixth day.* After about three weeks' illness these pigs died, and in them also all the lesions of typhoid fever were well established.

These experiments have since been repeated, and several others also had recourse to, with affirmative results. In due course the whole of the experiments will be reported.

Tuberculosis—Scrofula.—Attention has often been directed in former Reports to the prevalence of scrofula in several tribes of our improved Shorthorns, Herefords, and Devons, as well as among the more common breeds of cattle. The hereditary nature of this disease has also been dwelt upon, and the danger of breeding from animals which gave the slightest indication of the malady has been frequently alluded to. Some specimens of the affection having been received at the College, advantage was taken of the circumstance to institute a series of experiments. Several rabbits and guinea pigs were inoculated by Professor Axe with scrofulous matter, and these all died at various periods afterwards, exhibiting extensive deposits of similar material in various organs of the body.

Two cats were fed with portions of the lungs of a pig, the subject of tuberculosis, and both became affected. One died and the other was killed.

Some female rabbits were inoculated, and after a time, when evidences of the disease were fairly established, they were put to the male and became pregnant. Their young were killed at different periods after birth, and several of them were found to be the subjects of the malady. These and allied experiments have been repeated, and it has been fully established that *tuberculosis passes in rabbits from parents to offspring through several succeeding generations*, and that a third part of the young born of infected parents die from the disease.

In due course a detailed account of these experiments will also be reported.

To this Report three others are appended, which have been received from Professor Axe. Two of these have reference to *Hæmatosepsis*, "black-leg," in cattle; and one to *Splenic apoplexy*.

We also add a short Report by Professor Tuson of some cases of poisoning of cattle by a "feeding-cake," in which he discovered the deleterious material to consist of the seeds of wild mustard.

I.—*Report of an Outbreak of Hæmatosepsis in a Herd of Cattle, the Property of — Noakes, Esq., Yalding, Kent.*

The herd of cattle above referred to originally consisted of twenty cows, thirteen 2-year-old heifers and steers, fifteen yearlings, and nine calves. Of this number nine have died, *viz.*, seven calves, one 2-year-old steer, and one yearling heifer.

The disease first appeared on the 20th of February in a calf between four and five months old. This animal died in about thirty-six hours. From the date above mentioned to the 5th of March, seven calves succumbed to the effects of the malady in similarly short periods. On the 7th of March a yearling heifer also became affected and died after a very brief illness. The day previously to my visit a 2-year-old steer gave evidence of the disease and was still suffering on my arrival at Yalding. The symptoms presented by this animal were indicative of that form of blood-poisoning termed *Hæmatosepsis*, commonly known as "black-leg," "black quarter," &c.

On inquiry I gathered that the symptoms exhibited by the animals which had previously died were allied to those observed by me in the 2-year-old steer. To elucidate the cause of the malady a careful inquiry into the feeding and general management of the herd was made, special attention being directed to the calves in which the disease first appeared. These animals were between four and five months old, well grown, and fleshy. Their food consisted partly of milk obtained directly from their dams, together with a liberal supply of crushed oats, meal, pulped turnips, and hay and straw chaff. The dams of these animals were receiving, besides roots and chaff, six pounds of linseed-cake daily. The yearlings and 2-year-olds were also having a plentiful supply of roots with cake and chaff.

The water was derived from a brook, and with the exception of being rather turbid, seemed to be of good quality. The supply was abundant. All the animals were in large open yards, which were fitted up with good warm sheds, well littered with straw. With reference to the cause of the malady I am of opinion that its origin depended on a too liberal supply of highly stimulating food, which to a great extent was due to the liberal feeding of the cows. This conclusion is partly drawn from the fact that between the 20th of February and the 1st of March the disease altogether ceased, and that during this time no cake was given to the cows in consequence of the supply being exhausted. The immediate cause of the outbreak of the disease among the yearlings and 2-year-olds is not so apparent. It may, however, be mentioned with reference to the yearlings that the heifer which was attacked on March 7th had occupied a yard in which four of the calves had died.

The measures adopted for preventing the further extension of the malady consisted in a reduction of the quantity of food and the administration of aperient and antiseptic medicines. Instructions were also given that all manure should be removed from the stables and yards occupied by the diseased animals and be mixed with lime in the heap; and that the posts and rails of the yards, and the mangers and fittings of the sheds, should be well washed with water, and afterwards disinfected with carbolic acid solution. It is satisfactory to know that these measures had the effect of at once arresting the progress of the disease.

Since my visit to Yalding Mr. Noakes wrote as follows:—"I am very pleased to say that we have had no fresh attack of disease since you were with us."

II.—*Report of an Investigation of an Outbreak of Hæmatosepsis in a Herd of Beasts, the property of G. Wythes, Esq., Copt Hall, Essex.*

This herd consisted of 300 animals of all ages. They were divided into several lots, and occupied yards removed some considerable distance from each other on different parts of the farm. The disease first appeared on the 1st of March in a yearling calf; and out of thirty-three, of which this lot consisted, seven died. On the 16th of March, a yearling calf, located in a yard some distance from the calves above referred to, also succumbed to the malady; and on the 17th of March a 2-year-old steer was attacked and died on the same day. Besides these, several younger animals have recently died on different parts of the farm.

At the time of my visit (May 22nd), all the remaining cattle appeared healthy, and consequently I had not an opportunity of witnessing the symptoms manifested during the course of the disease. From the description, however, furnished to me by Mr. Wythes' bailiff, and the *post-mortem* appearances described by him, I have no doubt that the malady was none other than that commonly known as *black-leg*, *black-quarter*, &c. From a careful inquiry into the system of feeding and general management of the cattle, I am of opinion that the origin of the disease is to be referred to the large quantity of highly stimulating food of which the animals were partaking. This consisted of linseed-cake, bran, bean-meal, turnips, and hay and straw chaff, and besides this liberal supply the animals were turned to pasture for three or four hours daily. Other cattle less liberally fed, although of the same age, and placed under similar conditions, continued free from disease.

With regard to preventive treatment it was suggested that a dose of aperient medicine should be administered to every one of the remaining animals, and that this should be followed by repeated doses of antiseptic medicine. The yards and sheds occupied by the diseased beasts were ordered to be thoroughly cleansed, and likewise all the fittings and utensils used for feeding purposes. Complete disinfection of all places and things which had been in contact with the diseased animals was also strictly enjoined.

III.—*Report of an Investigation of an Outbreak of Splenic Apoplexy in a Herd of Cattle, the property of Mr. Handbury, Rodham Farm, Upwell, Cambridgeshire.*

The outbreak of the disease, above referred to, took place on the 20th of March and continued up to the 29th of the same month, the day of my visit. During this time, seventeen beasts, two sheep, and one horse, had either died from the effects of the disease or been destroyed at the outset of the malady. Three beasts and one horse were still suffering on my arrival at Upwell.

The herd of cattle originally consisted of forty-six 3-year-old heifers and steers. They were located in two yards; one of which was divided by posts and rails into three compartments, the other similarly divided into two. The disease first appeared in the south yard; here two animals died after a very brief illness. On the fifth day following these deaths, several animals in the north yard became affected. The number of cases was added to from day to day until seventeen animals had fallen a sacrifice to the malady.

On the 28th of March two sheep which were pastured with others in a field adjoining the farm-stead died suddenly; and on the same day one of several cart horses in a stable contiguous to the north yard, gave evidence of being affected. This animal rapidly became worse and died in the evening of the following day. I made a careful *post-mortem* examination of this animal, and found that the lesions which existed were in every respect identical with those commonly found in beasts affected with *splenic apoplexy*.

The herd of beasts had occupied the yards during the entire winter; their food consisting of oat and pea-straw, mangolds, and equal proportions of linseed and cotton-cake. Recently the quantity of cake had been materially increased, and the supply of roots doubled. I attribute the origin of the disease in part to this change in the amount of food supplied to the animals. The water supply to the farm premises was, however, bad, as it was derived from a nearly stagnant land drain, which also received the drainage from the yards and stables. It may be remarked that drainage from land of the kind farmed by Mr. Handbury, viz. black peat, highly charged with decaying vegetable matter, is at no time to be recommended, and when allowed to stagnate is highly objectionable for drinking purposes. In this instance I consider the water had played a very material part in the production of the disease. The fact that animals removed only a short distance from those affected, and receiving the same kind of food, but deriving their drinking water from a running stream, remained healthy, seems to strengthen this opinion.

The extension of the malady to the sheep and horses most likely depended on their supply of food being derived from meadows on which dogs had been allowed to eat the viscera of the dead animals. The sheep were pastured here; and besides this the horses were also nightly turned into one of the divisions of the north yard, which was only separated from the stricken beasts by posts and rails.

The measures suggested for arresting the spread of the disease had reference to these several supposed causes. The use of water from the land drain was forbidden. The cake and roots were reduced in quantity, and the yards and stables were ordered to be thoroughly cleansed and disinfected.

J. Wortley Axe.

IV.—*Three cases of Poisoning by Rape-Cake containing Wild Mustard.*

In December last, three samples of rape-cake, each bearing the same mark, but sent by persons residing in different counties, were forwarded to me for analysis, as they were believed to have proved injurious to stock. In one case the cake was given to thirty-seven animals (calves, 2-year-olds, &c.) in quantities varying from 3 lbs. to 6 lbs. Every animal that partook of the cake was more or less affected with symptoms of poisoning, which proved fatal to eight animals.

In the second case, two beasts were each supplied with a feed of between 2 lbs. and 3 lbs. of the cake. In about an hour afterwards both animals showed symptoms of abdominal pain, which continued for 24 hours, when they died. These were the only animals on the farm fed with this rape-cake. Other stock on the same farm fed entirely on linseed-cake have remained perfectly healthy.

In the third case about $1\frac{1}{2}$ lb. of the rape-cake was given to each of twenty-one beasts. All the animals were taken ill shortly after eating the cake, and three died the same night. The symptoms were indicative of narcotico-acrid poisoning.

The *post mortem* examination revealed in every instance, intense inflammation of the stomachs and intestines.

By chemical analysis and microscopical investigation, I discovered considerable quantities of wild mustard seed in each of the three rape-cakes, as well as in the stomachs sent to me for examination.

The conclusions arrived at from this and analogous cases of poisoning by rape-cake are:—

1st. That lengthened practical experience has established the fact that pure rape-cape is a perfectly wholesome food for cattle.

2ndly. That it is equally a matter of fact that wild mustard seed is an irritant poison, giving rise to inflammation of the stomach and intestines.

3rdly. That, under these circumstances, and owing to chemical and microscopical analysis having both demonstrated the existence of considerable quantities of wild mustard seed in the rape-cakes in question and in the stomachs of the animals the subjects of this communication, I am of opinion that such cakes are extremely unwholesome, and consequently unfit for feeding purposes.

4thly. That it is probable that the wild mustard seed was not in this instance purposely or intentionally added to the rape, but that both plants had grown together, and that their seeds were not separated before they were crushed and pressed into cake.

R. V. Tuson.

XX.—*Report on the Somersetshire Farm-Prize Competition*, 1875. By J. Bowen Jones, of Ensdon House, Shrewsbury.

Prizes were offered by the Royal Agricultural Society of England, in connection with its visit to Taunton this year, for the best-managed farms in the county of Somerset, under three separate heads, viz:—

Class I.—For the best-managed Hill-farm, including not less than fifty acres of arable land, and not less than one hundred acres of hill pasture, whether convertible or otherwise, and whether adjacent to the arable land or not, 50*l.*; for the second best, 25*l.*

Class II.—For the best-managed Dairy-farm, of not less than one hundred acres in extent, 50*l.*; for the second best, 25*l.*

Class III.—For the best-managed Farm, not qualified to compete in either of the foregoing Classes, and of not less than two hundred acres in extent, 50*l.*; for the second best, 25*l.*

The competition was limited to Tenant-farmers paying a *bonâ-fide* rent for not less than three-fourths of the land in their occupation.

The system of husbandry pursued on farms in each of these classes is distinct in its character, and as they are all largely represented in the county, the prize list would have been incomplete had they not all been embraced; it is, therefore, much to be regretted that the Society's offer did not elicit a more spirited response in Classes I. and II.

The entries for competition are tabulated on p. 518.

The instructions to the Judges were especially to consider—

1. General Management, with a view to Profit.
2. Productiveness of Crops.
3. Goodness and suitability of Live Stock.
4. Management of Grass Land.
5. State of Gates, Fences, Roads, and General Neatness.
6. Book-keeping.

	Names of Competitors.	Address.	Acreage.	Owner of Property.	Address.	Nature of Soil, as described by Competitor.	Remarks.
Class 1	Babbage, George	Nettlecombe, Taunton ..	221	Sir W. C. Trevelyan, Bart.	Wallington, Newcastle-on-Tyne, Northumberland	Light.	First Prize.
	King, Joseph..	Norton Hautville, Bristol	257	Mrs. Daubeney	Westbury-on-Trim, Bristol, Somersetshire ..	Very heavy..	Entered in wrong Class.
Class 2	Collins, Cornelius	Long House Farm, Orchard Leigh, Frome	161	William Duckworth, Esq.	Orchard Leigh, Frome, Somersetshire	Part heavy and part light.	
	Day, Robert Alfred ..	Oubley Farm, Bristol ..	180	Rev. Francis Arnold ..	Chew Magna, Bristol, Somersetshire	Heavy.	Second Prize.
	Gibbons, George	Tunley Farm, Bath.. ..	189	Miss Jarret	Camerton Court, Bath, Somersetshire	Light and heavy.	First Prize.
Class 3	Bowerman, Alfred ..	Capton Farm, Williton, Taunton..	265	Sir W. C. Trevelyan, Bart.	Wallington, Newcastle-on-Tyne, Northumberland	Chiefly light sand.	Second Prize.
	Bullen, William	Crewkerne	447	Viscount Bridport	Cricket St. Thomas, Chard, Somersetshire	Mostly heavy.	
	Culverwell, William T.	Durleigh Farm, Bridgwater	312	C. P. P. Brune, Esq., and others	Padstow, Cornwall	Medium.	
	Davis, John Gadd.. ..	Blagroves Farm, Milverton, Taunton..	211	Lord Ashburton	Alresford, Hants	Heavy.	
	Hembrow, Thomas ..	Slough Farm, Stoke St. Gregory, Taunton.. ..	202	Executors of the late W. H. P. Gore Langton, Esq., M.P., and others	Somersetshire	Heavy.	
	Hosegood, Obed	Dillington Farm, Ilminster	357	J. Vaughan, Esq., M.P. ..	Dillington, Ilminster, Somersetshire	Mostly sandy.	First Prize.
	Keen, John R.	Chewton Mendip, Wells..	325	Countess Waldegrave ..	Chewton Mendip, Somersetshire	Medium.	
	Lang, Thomas M.,. ..	Barrington Court, Ilminster	260	W. Parsons Peters, Esq., and others	South Petherton, Somersetshire		
	Mead, James..	Curry Mallet, Taunton ..	225	Prince of Wales, Major Barret (of North Curry, Somersetshire), and others	.. ..	Heavy.	
	Musgrave and Sons ..	Pyrland, Taunton	390	J. H. Warre, Esq. (Ramsgate), the Misses Yea, and J. C. Musgrave (Taunton)	.. ..	Mostly light.	
	Paget, Edward	Burnett, Bristol..	233	Charity Trustees of Bristol, and Rector of Burnett, Somersetshire	.. ..	Light and heavy.	
	Waltham, Thomas P. ..	Spaxton Court Farm, Bridgwater	255	E. J. Stanley, Esq.	Bridgwater, Somersetshire	Mostly heavy.	

The Judges made a preliminary inspection in the first week of December, 1874. It was of rather a hurried nature, and was principally undertaken to form an opinion of last year's root management with its results, autumn cultivation and cleanness of land, and general winter stock management.

Their second visit took place during the second and third week in May, the extreme lateness of the season inducing them to select that period in preference to an earlier date. The result of this inspection confirmed, in a very great degree, the hasty inferences drawn from a first acquaintance with the different farms. The third view was confined to seven farms in Class 3, all of which had more or less of general merit or some special features that were deemed worthy of further attention.

The characteristics of Somersetshire farming are very diversified, the variations being attributable to the marked differences of climate and soil to be found within the borders of the county and the changeableness of its geological formations.

The altitude of the Western Hill-district is very considerable, and, to a great extent, is accompanied by a corresponding sterility of soil. Dukerry Hill, the highest point in the county, is 1700 feet above the level of the sea; and one of the farms inspected on Brendon Hill is said to be nearly 1300 feet high. On the other hand, soils of a most fertile description exist in the vale of Taunton and in many other parts of the county; and some of the finest grazing land in the kingdom is to be found on the alluvial deposits and land originally reclaimed from the sea from Bridgwater to the mouth of the Yeo. To give an idea of the value of this land, the summer grazing of 1000 acres of the celebrated Pawlett Hams were let this year for more than 6000*l*.

The climate of the valleys is very genial and early.

It is not within the province of the reporter to enter into a dissertation upon the agriculture of the county; but in the course of the three visits, having driven through many parts of it, it may not be altogether out of place to briefly record a few of the impressions that presented themselves to the minds of the Judges.

As a rule, the general agriculture of the county is backward.

The fences are bad, both in form and in the description of wood of which they are grown. Maple, elm, oak, ash, hazel, and briar are the usual materials selected, the thorn being confined principally to the boundaries of railways and to the estates of a few improving individuals.

The farm-houses, for the most part, are inferior, and the farm-buildings dilapidated, and insufficient for the necessities of the occupations. As a proof of this, the general rule, observed by us in our winter inspection, was that none but a few feeding

cattle were housed at all on the ordinary run of farms, and we seldom passed a homestead in the early winter mornings without observing a herd of shivering animals in some adjacent field.

The cottages are very defective, and are built of various materials, according to the district they are in. Sometimes the walls are run up with mud, sometimes with rubble and some sort of mortar, and sometimes of better material, as is the case where stone is abundant. It is not improbable that many of the worst of them are freeholds or copyholds secured from common lands under the jurisdiction of the Lord of the Manor, but there is room for improvement in other districts also.

The enclosures are irregular and ill-shapen, and hedge-row timber is far too thick for successful agriculture in many parts of the county. On some farms the fields are small, and separated from one another by other occupations. An example came under our notice of a farm which contained 240 acres of land in one parish, and which was divided into 180 fields, mostly detached from one another.

Occupations of this description are often found to be held on a lease for three lives, a form of tenure that seems to have found favour in times past, but which is properly being abolished as opportunity offers. The tenants usually farm how they like, can fell timber for repairs much the same as on copyhold, but are not allowed to remove timber or minerals. The evils of intermixture of different holdings to a large extent must be patent to all, but the difficulties of exchange are found practically to be insurmountable.

But there is another side of the picture. Exceptions to indifferent husbandry among others beside competitors notably exist, and were apparent on many well-cultivated farms we passed by on our various drives, some of which were through unsurpassable scenery. New houses, buildings, and cottages showed themselves from time to time as we passed along, and in every instance the work seemed to be well carried out. That a move in this direction has taken place will also appear from the description of some of the inspected farms; and it would be unjust to the President of the Society, Viscount Bridport, if we did not here mention the very substantial improvements recently completed in the buildings of Mr. W. Bullen's farm, on his lordship's property, near Cricket St. Thomas, the outlay on which, although by no means injudicious, must have been very considerable. May these examples bear fruit. We will hope so; and that a new era, from which continuous improvement will date, commenced with the visit of the Royal Agricultural Society to Somersetshire in 1875.

Class I.—Hill Farms.

Mr. George Babbage's farm is situated near Raleigh's Cross, on Brendon Hill, which is fifteen miles north-west of the town of Taunton, and is one of the steepest ranges of the Western Hill district of the county of Somerset. A splendid drive of six or seven miles from Williton through a continuously rising country, with fine views of the Bristol Channel and its contiguous bold Welsh mountain scenery, and past the picturesque and finely timbered park of Nettlecombe, the undulating ground of which was covered with majestic oaks and magnificent elms, beeches, and pines, brought us to the partially enclosed moor of Brendon Hill, extending from the top of the park to Raleigh's Cross Inn. At this place Tone Farm land commenced, and continued a distance of some half-mile in a westerly direction. At the south-west extremity of the land is a ten-acre plantation of spruce and firs, which appear to be thriving, but no more woods shelter the farm in other directions.

The farm is stated to be elevated some 1300 feet above the level of the sea. The soil rests upon a shaly formation locally termed shale rag, which is within four or five inches of the surface. It contains beds of ironstone which have been quarried on the farm, and mining for ironstone immediately adjoining it is now carried on by the Ebbw Vale Company. This stone is sent by a mineral railway to Watchet, whence it is transported to the Company's works in South Wales.

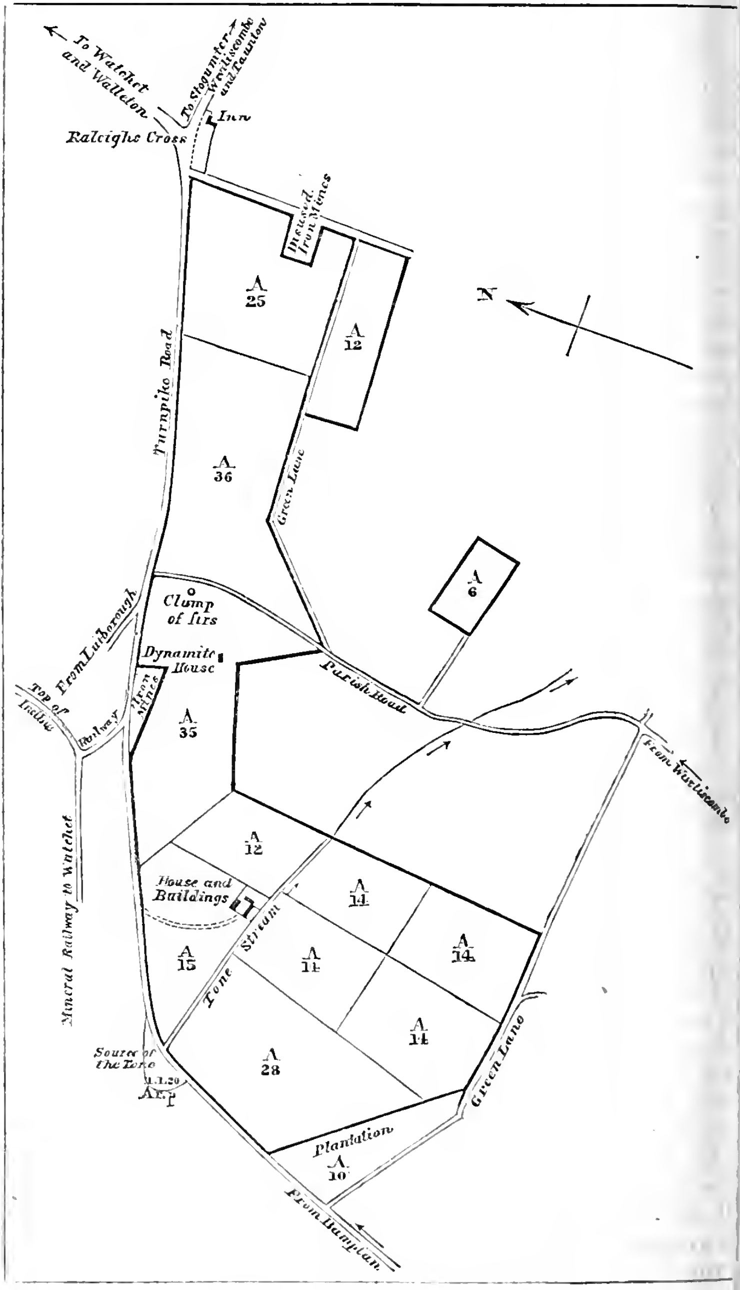
The River Tone rises in the upper part of the farm, but does not increase to more than a miniature brook while on the land, although ultimately it swells into an important river, running south and then east into the Parret at Stanmore Bridge. Part of the land slopes slightly towards the brook, forming a valley, one side of which faces N.N.E., the other S.S.W.

The farm, as will be seen by the annexed plan (p. 522), is laid out with some degree of regularity, but its length is disproportionate with its width.

The soil is for the most part of a light nature, and some of the more recently broken-up fields contain a good deal of vegetable matter. There are something like 6 acres of bog on the whole farm, but, with the exception of this, 10 acres only were found to require drainage, which was done by the owner of the property before the present tenant's entry.

The climate is severe, and the district is more backward by three weeks or a month than the Vale of Taunton. The rainfall is also excessive, being more than half as much again as the average of the lowlands.

Fig. 1.—*Plan of Tone Farm, in the Occupation of Mr. George Babbage*



The thick line shows the boundary of the farm.

The farm is held on a fourteen years' lease, four of which are ınexpired. There is no stipulated tenant-right in the covenant, ıeither does the custom of the country admit of any. The ıgreement provides for a system of farming which is tolerably :losely described in Mr. Babbage's course of cropping, excepting :hat, as a rule, he allows his grass land to remain down an addi- :ional year. The term commences at Lady Day.

The homestead is rather inconveniently situated, nearly at the vestern extremity of the farm. The house, which is built of he stone of the district, contains two sitting-rooms, kitchen, lairy, pantry and washhouse, with six bedrooms.

The farm-buildings, also erected with the same material, onsist of one range occupied by a cow-house for milking cows, nother for tying-up cattle, with a loose box adjoining; also barn nd chaff-house, with granary above, and stable for horses, behind vhich is a carthouse, and an enclosed shed for young stock acing the stackyard, which is 120 feet square.

The cattle-yard is at the back of the dwelling, and in front f the range of buildings first alluded to, and is formed by a bank f earth cased up with stone running parallel to it, returning at ight angles on the one side to the house, and on the other to he end of the building. An open shed, which is thatched, ests on a portion of this wall. The garden is in front of the ouse. The premises are well kept, and are sufficient for the olding, the dwelling more especially so.

Land.—Of the 221 acres which comprise the whole farm, not ven exclusive of the 15 acres which remain in a state of nature, one can accurately be described as permanent pasture, although, s we shall see from the course of cropping adopted, a con- iderable proportion is always in grass.

The land under cultivation, therefore, somewhat exceeds 200 cres. The whole of this, with the exception of about 20 acres, as unreclaimed at the commencement of the tenancy. Heather nd whortleberry principally prevailed, and the scant herbage ıat existed was of a poor character, and barely sustained a few ıeep in the summer months. Of the remaining 15 acres of nconverted hill it is intended to reclaim about 6, the rest eing unfit to bring into cultivation, owing to the fact of the soil ontaining a mass of loose quartz-stones of various sizes, which ould be quite unmanageable in a course of tillage.

The method pursued for conversion and speedy cultivation as as follows:—The surface was breast-ploughed and burnt, and ıe ashes were spread, at a cost of 30*s.* to 35*s.* per acre; the land as then ploughed about 5 inches deep. The principal obstruc- ons met with were quartz-boulders varying from ½ cwt. to 2 tons, hich caused considerable trouble in removal as well as break- ge to the implements. Eight to ten hogsheads, equivalent to

about 2 tons per acre, of fresh-slacked lime was then applied and well intermingled with the soil by dragging. Turnips and rape were afterwards sown, harrowed in, and the land well consolidated by rolling. Lime is procured from the blue lias limestone, quarried from the sea-bed at Watchet, and delivered by the mineral railway at 15*s*. per ton. It is only used for the first crop after breaking up the hill pasture.

After the foregoing preparation the following rotation was commenced, and has not since been deviated from. Oats were the first crop grown; they are sown about Lady Day, and 14 pecks of seed per acre are drilled. The land is ploughed as soon after Christmas as the weather will permit, and simply harrowed to get a good tilth before putting the seed in. After harvest, which is usually commenced about the third week in August, the stubbles are worked, and cleaned and ploughed to stand for the winter, and are left until the following May, when they are again scarified, ploughed, and otherwise prepared for the root crops.

A few mangolds and carrots are sown in May; swedes are sown about the 10th of June, and common turnips towards the end of June or beginning of July; about $1\frac{1}{4}$ to $1\frac{1}{2}$ lb. of seed per acre being drilled on the flat a distance of 16 inches between the rows with Reeves Brothers, Westbury, Wilts, manure-drill. Two cwt. of dissolved bones, at 6*l*. 10*s*. per ton, and 2 cwt. of superphosphate, at 4*l*. 10*s*. per ton, mixed with earth and ashes, are deposited under the seed, the former costing 13*s*. and the latter 9*s*., making a total of 22*s*. per acre.

Farmyard-manure is occasionally ploughed in at the last ploughing for swedes. After the turnips are fed off the land it is ploughed up, and in the following April sown with rape and grass-seeds, either mixed together and sown broadcast with 2 or 3 cwt. of artificial manure; or the rape is drilled with a similar quantity of manure, and the clovers and grass-seeds distributed separately. Mr. Babbage states that when spring vetches are cheap (say 6*s*. per bushel), he substitutes them in part for rape, drilling 2 bushels per acre, but applying no artificial manure, so that the cost amounts to about the same. The grass remains down three years inclusive. In seeding out with rape (as it is locally termed) the following descriptions and quantities of seeds are used:—

Rape, if drilled, 3 lbs.
Rape, if sown broadcast, 5 lbs.
White Dutch clover, 3 lbs.
Alsike or hybrid ditto, 3 lbs.
Trefoil, 6 lbs.
Italian rye-grass, 3 pecks.
Scotch rye-grass ditto, 2 pecks, or 3 pecks where no Italian rye-grass is used.

Mr. Babbage considers that all land of the description he arms should be seeded out with rape in preference to a corn crop, he grass being more abundant and luxuriant than when sown vith grain, and the rape producing an especially healthy change or lambs.

A small proportion of six or seven acres of grass is usually nown annually, and this invariably consists of the second year's growth. Occasionally no hay at all is harvested, the deficiency n such a case being made good by an increased consumption of nome-grown oats. The farmyard-manure is almost all applied o the grass, sometimes in November succeeding the seeding out, at others one year later.

It will be seen from the foregoing remarks that the course of ropping is of five years' duration, and may be summarised—

Oats,	Seeds and Grass,
Roots,	Seeds and Grass.
Rape seeded out,	

The autumn inspection of the Judges enabled them to see the stubbles and a portion of last year's roots. The former were satisfactory; the latter, which were being fed off with sheep, were small and not very carefully singled, the reason assigned being that as they had suffered so much from the early drought of 1874, it was thought that more keep would be produced by leaving them thick in the rows. They were certainly too thick o have made much size, especially as the rows are placed so hort a distance apart—a practice that may be suitable to a ate poor district, but which seems to be very generally adopted hroughout the county.

ACREAGE under respective CROPS this Year.

	Acres.	
Oats, black	36	
„ white	18	
		54
Maugolds (Yellow Globe)	2	
Carrots (White Belgian)	$\frac{1}{2}$	
Swedes (Sutton's Champion)	$9\frac{1}{2}$	
Turnips (Green Round)	20	
		32
Rape seeded out	41	
Second year's grass	37	
Third year's grass	42	
Unreclaimed, six of which are being made available	15	
		135
Total		221

At the second inspection of the Judges, which took place on

May 21st, they found the oat-crops looking well: they were regular, of good colour, elean, and just rolled down.

The small breadth of mangolds and earrots were up and thriving, and the fallows were in course of preparation for swedes and turnips, and were in fair condition. The two- and three-year seeded-out land, especially the latter, did not show any excessive vitality, but this may be to some extent aceounted for by the backwardness of the season, combined with the inclemency of the district. The three-year-old grasses were apparently degenerating, and it seems obvious that land of this description would run foul if left down much longer; the exposed situation and indifferent quality of the soil being unable to sustain with vigour and improvement the artificial grasses of the rotation beyond this period, even under liberal treatment, and a good system and practice of husbandry. On the other hand, however, the fields sown with oats on this farm showed but little signs of weeds or couch, so that it is conclusive that this sort of land, well cultivated, need not necessarily run foul at the end of such an extended course of grass as is here carried out.

Stock.—The quantity of stock supported on the farm is somewhat difficult of assessment, from the fact of Mr. G. Babbage's brother occupying a valley holding, to which from time to time the Hill Farm stock are permitted by arrangement to descend.

QUANTITIES and DESCRIPTION of STOCK on TONE FARM.

First Inspection, November, 1874.		Second Inspection, May 21st, 1875.	
CATTLE.		CATTLE.	
Cows	13	Cows (and 1 calf)	8
Yearlings, mixed heifers, and bulloeks	12	Cows, Yearlings, and calves	19
Calves	4		
Total	29	Total	27
SHEEP.		SHEEP.	
Stock ewes	200	Stock ewes with lambs	111
Off ewes	85	The above lambs	111
Ewe tegs	85	Off ewes and unsold wether tegs	94
Wether tegs	110	Ewe tegs	104
Total	480	Total	420
HORSES.		HORSES.	
Working	5	Working	4
Ditto laid by in yard	1	Mares in-foal	2
Hack mares in-foal	2	Colts and hacks	6
2-year-old colts	2		
Yearling ditto	2		
Total	12	Total	12

The cattle and horses are supposed not to leave the Hill Farm until they go for good; but contingencies probably produce some variation of this rule. The sheep are always sent down for a portion of the winter. If the rule were rigidly adhered to, the farm would carry the following quantity of stock from May to May:—

Cattle, 27.
Horses and colts, 12.
Ewes and lambs from May to January, 200 ewes with lambs; and the off ewes, about 90 to 100, from May till August.

Taking into account peculiarities of seasons and other causes (as this year, through the unusual severity of the winter, we ascertained that two mares and colts were away four months of the winter, and some rough keep was also hired), it would be fair to assume the totals of stock supported on the farm at

Cattle, 27.
Horses and colts, 8.
200 stock-ewes, with their lambs, from May to December.

This, as may be supposed, will bear a favourable contrast to the numbers of stock carried on the farm when Mr. Babbage first occupied it.

Cattle are of the Devon breed. The cows produce their calves towards the fall of the year, the heifers coming into profit as two-year-olds, and dropping their calves as near grass as possible. The calves remain with their mothers for five or six months, during which, if in winter time, they are housed, and are allowed some cut turnips and $\frac{1}{4}$ peck of oats a day, mixed with chaff. They run on the grass in the summer, and go off as yearlings in store condition, with the exception of such heifers as are drafted into the stock. The cows run in the strawyard during the winter, living principally upon oat-straw, with a few turnips.

The cows are usually sold in store condition, as the heifers are drafted in. Occasionally a few heifers are fattened, but this is exceptional. Four were fattened last winter on a peck of wheat-meal a day, in addition to their turnips and straw.

Sheep are of the Devon Long-wool breed. The 200 stock ewes, averaging about one lamb each, come up with their lambs in May. The yearling ewes follow them. After the lambs are weaned in June, the off-ewes are drafted from the flock of stock ewes, principally by seniority, and are replaced by the yearlings, which amount in number to about 90. The 90 turn-off ewes continue to run the grass till August, and are finished fat on the lower farm about a month later, averaging something like 90 lbs. the carcase.

The lambs are hurdled on the turnips, the sexes being divided,

and the wethers receiving $1\frac{1}{2}$ pint of oats per diem, with chaff, until they descend to the lower land when they have done the turnips, there to be finished. They approach 20 lbs. per quarter, in May, and are sold out of wool. The ewe lambs also run the turnips during the same time, as also the stock ewes; but neither of these flocks receive any corn unless the weather is very severe, in which case they are allowed one pint of oats a day *pro tem.* The turnips are not cut for any of the lots. The whole of the sheep go down the hill together when the roots are completed, and the lambs are dropped before they return.

The clip of wool averaged 8 lbs. this year.

Horses.—The four working horses are of a useful stamp. The remaining colts and hacks are half-breds and roadsters. The horses live through the winter on oaten-sheaves cut into chaff, and as many swedes, mangolds, and carrots as they require. In the summer they go into the pastures.

Fences, Roads, Water, and General Neatness.—The fences, three-fourths of which were planted before Mr. Babbage took the farm, and the rest since, at the expense of the landlord, are rather better than the usual Somersetshire pattern; they have been properly laid out in straight lines, and their high banks are also of utility in so exposed a district as a means of shelter. The banks are some 6 feet wide at the bottom and 4 feet at the top. Their height is about 5 feet, and they are occasionally, near roads or gateways, cased on either side with stones. The hedges are all of beech, which is planted in double rows on the top of the banks. They appear to be thriving well, and are allowed to grow to a height of 10 or 12 feet, being only laid down when they are becoming open and the adjacent land is in grain. The top of the bank is then protected with a layer of blackthorn on either side till the hedge has again grown up. The turnpike-road runs past the mines on one side of the farm; an occupation-road crosses the centre of the land, and another skirts its north-east section. The gates and premises are neatly kept.

Part of the fields are supplied with the surplus water from the ironstone mines; the others from the Tone.

Labour, &c.—Four men of all sorts are kept:—

Carter	12*s.* 0*d.*	per week.
Lad ditto	10*s.* 6*d.*	,,
Stockman, with farm-house and garden, and firewood . . .	11*s.* 0*d.*	,,
Old man at	8*s.* 0*d.*	,,

Cider is given in the harvest, also to the men for corn-threshing; and sometimes in hot weather.

The old man works or not, optionally, and earns about 6*s.*

per week; so that the weekly average cash payments for labour are under 2*l.*

	£.	s.
Total weekly payments for year, exclusive of harvest	88	0
Additional payments:—		
Threshing (coal inclusive)	12	6
Harvesting, cutting and binding (contract) . . .	7	15
Cider, 5 hogsheads at 25*s.*	6	5
Stockman, cottage, garden, and firing	5	5
	£119	11

Or about 11*s.* per acre.

The average weekly wages on the farm the first three years of occupation was 1*l.*, with other extra items on a proportionately lower scale than at the present time. The outlay for labour has therefore doubled within the last ten years.

The hours of labour are from 7 A.M. to 5 P.M.

Horses work from 6 A.M. until 2 P.M. without resting.

The oats are bound up, stacked, and carried by contract, the cutting being done by Hornsby's manual-delivery machine by day-work.

Threshing is accomplished by a hired portable steam-threshing machine.

The Judges considered that Mr. Babbage's farm was well managed, and had some especial features of interest; and although the competition was insufficient for them to award the prize, they had great pleasure in finding that the Council readily agreed to their recommendation to do so.

Class II.—Dairy Farms.

First Prize Farm.

Tunley Farm, near Bath, in the occupation of Mr. George Gibbons, consists of 43 acres of arable land and 155 acres of pasture. It is a short distance from the Camerton Collieries, about six miles south-west of Bath, and is approached from that town through a beautifully undulating and ever-varying country.

The rapidity of change of the geological formations in some parts of Somersetshire is strikingly exemplified on this holding. The house and buildings stand towards the north-eastern extremity of the farm, on a bank upon which some fifteen acres of the oolite crops out. Surrounding this as the hill is descended, the lias is clearly and abruptly defined. It occupies the larger part of the holding, extending across the road to the lower end of the farm adjoining the canal, where the new red sandstone comes to the surface on an area of about thirty acres.

The coal measures are worked close by at the Camerton Collieries, where coal is found immediately under the new red sandstone at 100 to 150 fathoms' depth.

The soil is by no means naturally rich, and it varies a good deal in character, as may be supposed from the marked changes in the geological constitution of the subsoil. It runs from the light friable texture of the oolite to the stronger new red sandstone, and the still more retentive lias, with its clay subsoil.

The rainfall is much the same as in the neighbourhood of Bristol, and the climate is considered moderately good, although the district is not so early by two to three weeks as the richer vales of central Somersetshire. Harvest operations usually commence on Tunley Farm, which is in rather an exposed position, about the latter end of August.

The tenure is from year to year, and the tenancy commenced Lady Day, 1859.

The occupation was considerably increased this year, and now contains a double quantity of arable and grass land.

The extensive enlargement of the buildings, hereinafter referred to, is in some degree due to this increase in the acreage of the farm.

In this neighbourhood the incoming tenant, by custom, usually takes possession of the homestead and all the land at Lady Day. He pays for seeds, labour, and tillages on the arable land, and for hay and straw at market price. On some farms the outgoing tenant is entitled to an offgoing crop of wheat; and in other instances, where the outgoing tenant has fed off his green crops, the allowance for tillages is reduced to one-half the cost, and half a year's rent, tithe, and taxes are returned to him.

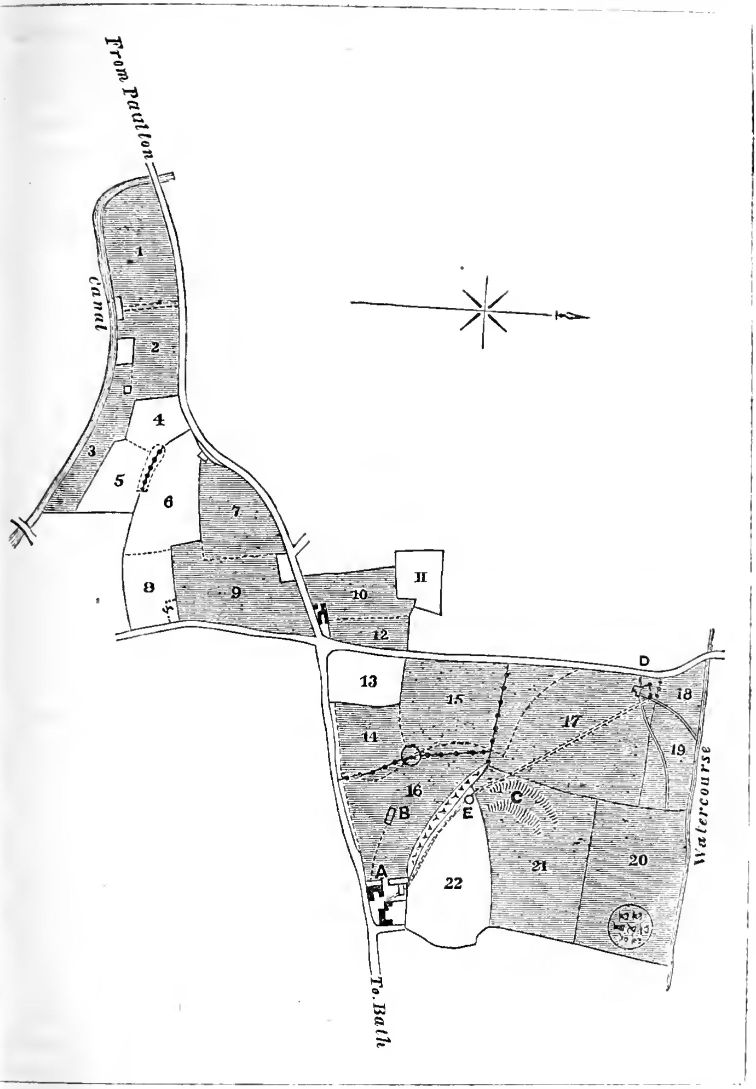
A stipulation is generally made that the quantity of hay and straw left at the expiration of a tenancy shall not exceed a given number of tons. There is no tenant-right by local custom or private arrangement.

The comprehensive plans which accompany this Report, and for which the writer is indebted to the courtesy of Mr. Feare, of Camerton, the agent of the estate, will best illustrate the work now nearly accomplished at the homestead, as well as the alterations and improvements effected on the farm (see Figs. 2 to 5).

The house and buildings are for the most part built with stone, and are very substantially erected. The dairy adjoins, and its arrangements, which are hereafter described in the Report furnished by my colleague, Mr. E. Little, of Lanhill, Chippenham, are of a very complete character.

The buildings (Fig. 3) now consist of the older portion, which is constituted by a range of stabling for carthorses and hacks, adjoining and nearly in line with the dwelling; the principal pig-

Fig. 2.—*Plan of Tunley Farm, in the Occupation of Mr. George Gibbons.*



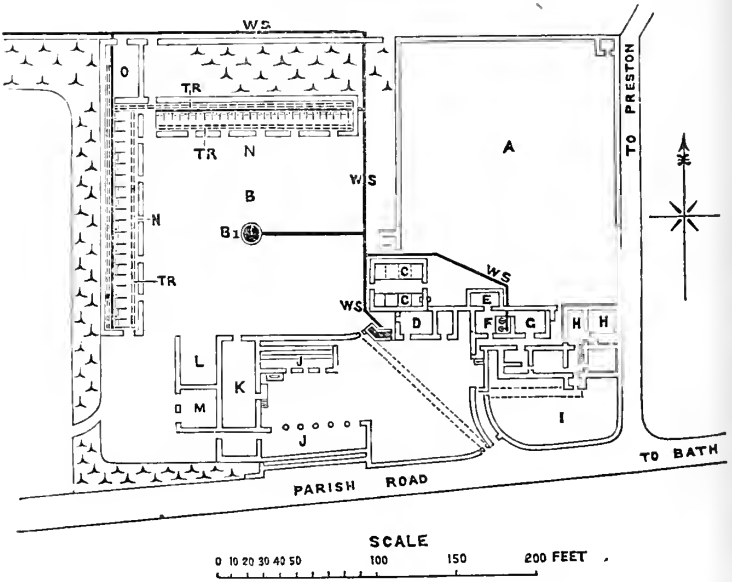
A. New cow sheds.
B. New liquid-manure tank and drain.
C. Old entrenchment.
D. Water ram, spring, and reservoir, connected with
E. Water tank.

The dotted lines show the old fences now removed; the solid lines show old fences retained; and the beaded lines new fences substituted.

The grass land is tinted; the arable land left white.

geries at the back and in close proximity to the whey-house, into which the whey is conveyed from the dairy by means of pipes and mixed with meal for the feeding-pigs; two cowsheds, containing 33 ties, and a small milking-yard; also a superior waggon-house of more recent construction, with sheds at back, over which is a good granary and general storeroom. In the barn a chaff-cutter, worked by a 3-horse-power engine which is connected with it, is conveniently fixed, and a mill for grinding corn is worked by means of the same machinery.

Fig. 3.—*Plan of Farm Premises on Tunley Farm, in the Occupation of Mr. George Gibbons.*



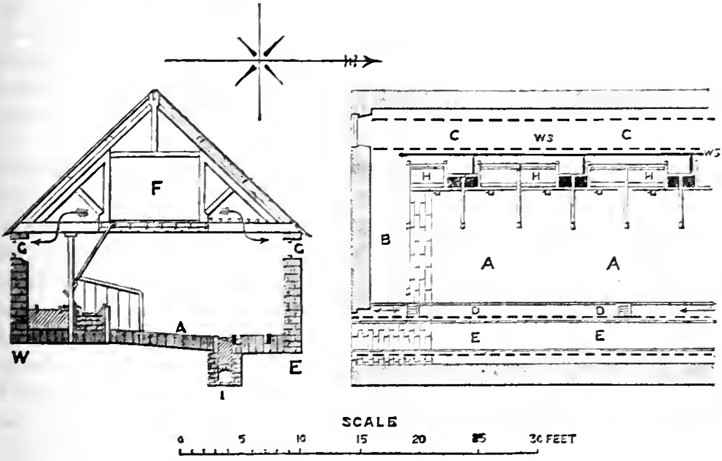
A.	Garden.	I.	Lawn.
B.	New yard.	J.	Old cow sheds.
B 1.	New drinking pond.	K.	Barn.
C.	Piggery.	L.	Waggon house.
D.	Stables.	M.	Sheds and granary over.
E.	Whey house.	N.	New cow sheds.
F.	Scullery.	O.	Fodder room and loft over.
G.	Dairy.	W S.	Water supply pipes.
H H.	Kitchens.	T R.	Tramways.

The new cowhouses (N), recently erected, and barely completed at the period of our last visit, are built of good lias stone, and are of a very superior description. They consist of two lines of buildings of equal length, running at right angles to one another to the rear and west of the old premises, and forming with them a large milking enclosure (B). In the centre of this yard is a drinking-pond (B 1). The land at the back of the old premises, and where

the new buildings now stand, formerly rose rather abruptly. It has been excavated sufficiently to admit of the hay and straw-lofts of the new cowhouses being on a level with the table-land to the rear of them. Here the stackyard is placed close to the angle of the two ranges of building; and hay and straw are readily supplied to the lofts with a very inconsiderable amount of labour. The width of the erection is 25 feet, which gives ample space both in front and behind the animals. A tramway for the removal of manure runs at their heels. The whole of the manure is carried to the lower or south end of the building, and is there tilted into a yard set aside for the purpose. Another line of rails runs in front of the cattle for the supply of grains and other food. The cribs are of Bath stone, and there is a drinking-cistern for each two cows supplied by a pipe from a reservoir on a higher level.

Figs. 4 and 5.—*Plan and Section of Cattle Sheds at Tunley Farm.*

Fig. 4.—Section. Fig. 5.—Plan.



- **A.** Pitched floor—Pennant stones.
- **B.** Passage.
- **C.** Fodder tramway on asphalt walk.
- **D.** Open surface gutter over drain.
- **E.** Manure tramway.
- F. Straw and fodder loft.
- G. Ventilation.
- H. Cribs, &c.
- I Drainage adit.
- W.S. Water supply pipes.

The flooring is of Pennant stones, and is also pitched; and at the back of the cows is an open gutter, with occasionally gratings communicating with the underground drain. The fodder-loft is ingeniously arranged, occupying about two-thirds the width of the houses. The one side is used for hay, which is placed in the cribs by being slipped over the inclined plane, shown in Fig. 4; the other for straw, which is thrown over the opposite side

for littering the animals. Glass windows are arranged in the roof—high up on the one side for giving light to supply the cribs, lower on the other for littering and cleaning out the animals. The urine from these stalls is carried away by means of drains shown in the section (Fig. 4). It runs into a small well at the end of the buildings, to which the drainage of the whole of the rest of the premises is brought. From this point it is all conveyed by means of a 9-inch pipe to a large tank of sufficient capacity to contain 400 hogsheads, which is situated on the brow of the hill in the adjoining cow-pasture, marked B on the plan of the farm (Fig. 2), and 150 yards' distance from the confluence of the drainage. The conformation of the ground here admits of its being used for irrigating some four or five acres of grass land, the overflow being capable of diversion in three different directions. Its effects are very marked and advantageous. The land on the lower side of the tank has been cut away, and a roadway formed of sufficient depth to admit of a 3-hogshead water-barrel being filled in the course of a few minutes by means of a hose, with a screw-tap. The liquid manure from this tank is used for roots, which are sown with the liquid-manure drill; and at other times, when there is a superabundant supply, it is carted out in the barrel, and distributed generally on the pasture land not otherwise amenable to its influence.

The water-supply was originally derived from wells which, in times of drought, were very deficient. It is now procured from a never-failing spring of good water, some half-mile distant from the house on the western side of the farm, and 200 feet below the elevation of the buildings. An hydraulic ram, capable of lifting 4000 gallons per day, forces a supply into the reservoir marked E on the plan (Fig. 2). This reservoir lies at the back of, and above, the homestead, and the premises are supplied from it in the most convenient manner, taps being arranged at the points where it may be required. A tap also intercepts a supply of water for the threshing-engine when at work in the stackyard, while other pipes continue from the premises to the new portion of the occupation on the lower side of the turnpike-road.

The artificial pool into which the spring is conducted for forming a head of water for working the ram, is inclosed by a strongly-built wall, cemented, and sunk into the clay, to render it water-tight. Its dimensions are 40 yards in length, 10 yards in width, and 4½ feet in depth; the object of so large a dam being to insure an unfailing supply of water. A sheep-wash adjoins. It is 5 yards long by 3 yards wide, and is supplied by the overflow from the dam, which, after running through it, is conducted by means of a 9-inch pipe into the meadow below,

where it is utilised for irrigation, eventually falling into the watercourse that runs below.

There must have been a large outlay on these various improvements. The fact, however, remains that the work has been well done. If we refer to the new cowsheds, which are constructed to accommodate 70 head of cattle, we find that no detail has been lost sight of; and if we revert to the water-supply, or the removal of the drainage, we can discover no flaw in the work, which has been perfectly and thoughtfully executed. Effect has not been sacrificed to utility; and in the long run, durability and convenience of arrangement will, no doubt, recoup both landlord and tenant for the primary outlay that both have incurred on these permanent improvements, and which will for many a year to come be a standing memorial of what can be done by the hearty co-operation of owner and occupier.

Grass Land.—The pasture land consists of 155 acres, being between three and four times more than the arable portion. It is not of first-rate quality.

The meadows are not especially reserved for hay; the practice being to mow and graze the greater portion of the pastures alternately. Nearly half the grass is mown every year, as a large supply of hay is required for the milking-cows in the winter. The work is done by machinery. The fields are for the most part of considerable size. Those adjoining the turnpike-road are divided by iron fencing, the rest by some of the older cattle-fences characteristic of the county. A considerable outlay has been made by the present occupier in removing old hedges, levelling banks, and filling in ditches in the fields by the road-side, and also in dimishing the large banks of the older fences still remaining. Experiments on a small scale in top-dressing the grass with phosphatic manures have been tried, but the result was not deemed sufficiently satisfactory to justify the continued application of these fertilisers. Liquid manure from the tank is distributed by the barrel. It is very effective in its action, and supposed to pay well for the labour of removal. Salt is also used as a top-dressing, and found to be beneficial; and the whole of the farmyard-manure, after being mixed with road-scrapings, is spread on the pastures with invariably good effect.

Arable Land.—The four-course system of husbandry is pursued on the cultivated portion of the farm, which is 43 acres. The rotation consists of wheat, roots, barley or oats seeded, seeds.

Intermediate Crops and Roots.—Winter tares are grown on the bulk of the wheat-stubbles, and are always consumed on the

land in the spring and summer, before it is put into swedes or common turnips, the latter succeeding the last fed parts.

Swedes and turnips are alternated as much as possible on the same land, on the recurrence of the root course. They are sown 20 inches apart on the flat, and set out a distance of 12 inches: 4 cwt. to 5 cwt. per acre of superphosphate dissolved in liquid manure are applied at the time of sowing, by means of the liquid-manure drill.

The Grey-stone, Green Round, and Yellow Tankard varieties of turnip are grown; the first-named being put in soon for early keep, and the other sorts sown towards the end of July, and preserved for later grazing. The Improved Purple-top swede is also grown, and generally sown the first week in June. The green crops and roots are all consumed upon the land by sheep receiving a considerable allowance of corn. This system of treatment, with the addition of the direct application of liquid and artificial manures, is found to sustain in a high state of fertility land that has for many years received but a very small proportion of the farmyard-manure.

Barley.—Imported Scotch Chevalier barley is generally put in at the rate of 8 to 10 pecks per acre in March, and is found to be very productive.

Clovers are sown with the spring grain-crops. Pure red clover is never grown more than once in eight years, the alternate course being laid down with a mixture of white Dutch, alsike, trefoil, and Italian rye-grass.

Wheat.—The leys are ploughed in September, and generally sown the end of that month or the beginning of October. Browick red is found to be the best sort for autumn seeding, and 2 bushels of seed are put to the acre. Sometimes "Talavera" is sown in the spring at the rate of $2\frac{1}{2}$ to 3 bushels per acre, and is found to do well. The advantage of spring-sowing is the prolongation of the clover-grazing in the autumn if the ley is doing well, or otherwise the ley is ploughed and a crop of mustard intervenes, and is fed off before sowing the wheat in the spring. The disadvantage would be the great uncertainty that always exists in being able to secure a productive return from spring-sown wheat.

The crops growing on the land at the present time indicate a diversion from the true course of rotation.

This arises from two causes.

1st. The calamitous drought of the season 1874.

2nd. The increase in the size of the occupation.

Field No. 4 and 5, on Fig. 2, should this year have been wheat; field No. 6 and 8 should this season have been seeds, 4 acres of

ACREAGE UNDER RESPECTIVE CROPS.

Numbers of Fields on Map.	Acreage.	First Inspection, Nov. 2, 1874.	Second Inspection, July 1875, or to follow.
4 & 5	10	Mustard, early turnips, and rape after trefoil and Italian rye-grass, mown and grazed.	Barley seeded with mixed seeds.
6 & 8	14	Rape and mustard after barley, where seeds had failed.	Rape and turnips after mustard; swedes after rape.
11	$3\frac{1}{2}$	Rape fed after winter vetches, fed also.	Oats seeded.
22	7	Rape fed..	Barley.
	7	Winter vetches after wheat ..	$4\frac{1}{2}$ swedes. $2\frac{1}{2}$ turnips.

TOTALS.

Barley	17	acres.
Oats	$3\frac{1}{2}$	,,
Rape and turnips	$9\frac{1}{2}$	,,
Swedes	$11\frac{1}{2}$	,,
Showing in cereal crops	$20\frac{1}{2}$	acres.
Ditto green crops	21	,,

which would probably have been broken up for common turnips; and 7 acres of field 22 should have been seeded down with the barley. The result would have been:—

Wheat,	10	acres.
Barley and Oats,	$10\frac{1}{2}$	,,
Clover,	10	,,
Roots,	11	,,

The divergence has arisen as follows:—

The 14 acres of seeds failed last summer in field 6 and 8. It had therefore to go into green crops and roots.

No. 4 and 5 was sown with barley and seeded in order that the 7 acres in No. 22 should not be laid down with clover, the object being that the whole of that field shall come under one crop next year to suit the new holding.

First Inspection.—When the Judges were at Tunley in November, they found that the dry summer had considerably affected the arable culture, as has been explained in referring to the crops on the ploughed land. The hay had proved a deficient crop, not amounting to much more than a third of the average, which would be about 95 tons. The land was clean and in course of cultivation for the ensuing crops. Most of the sheep and lambs had been sold off fat. The dairy cows and young stock were looking well.

Second Inspection.—At their second visit they found the barley looking rich and dark in colour, a portion being apparently too thick and luxuriant. A very good piece of winter vetches was being fed off with ewes and lambs, the latter running through Carson and Toone's lamb-hurdles, and taking the head of the crop, at the same time receiving $\frac{1}{4}$ lb. each of linseed-cake per diem, while the mothers were daily moved to clear up after their offspring. This field was afterwards sown with swedes and common turnips. The other land for roots, like that now referred to, sustained the indications of cleanness and good cultivation that were noticeable at the autumn inspection.

Live Stock on Tunley Farm, May 1875.

48 dairy cows.
14 yearling heifers.
2 bulls.
100 ewes and lambs.
70 pigs.

Cattle.—The fine dairy of cows is the chief feature in the live stock. The cows are very useful unpedigreed Shorthorns, and are now being improved by a lengthy and well-made 9-year-old bull, who boasts a direct lineal descent from the celebrated "Master Butterfly." Heretofore the calves have been sold at 3 weeks old; and from the well-known attributes of Mr. Gibbons's herd, have on a 3-years' average realised as much as 3*l.* each at that age. This year his demand was much diminished, and 2*l.* per head was the amount obtained for them.

Until last year, the calves, with trivial exceptions, have hitherto been all sold, and 3-year-old heifers purchased in the spring to take the place of the older cows drafted from the dairy. These have been disposed of in good store condition, to be finished by graziers or feeders on farms suited for that purpose.

In the future, 10 to 15 heifer-calves will be reared, to take the place of the drafts from the dairy, and in anticipation of the increase of the farm, this system was commenced last year by the retention of 13 well-selected calves.

The cows are all well cared for. In the past they have been kept in during the winter, as far as the accommodation of the buildings would admit; and in the future all will have house-room. After calving they are fed on hay, chopped straw, and brewers' grains, with a little meal, and a daily allowance of 4 lbs. of linseed-meal each; this is continued until a short period after they have been turned out permanently to grass in

May. The apparently large area of $1\frac{1}{4}$ acre of grass is allotted to each cow for the summer, irrespective of the herd having the run of the aftermath when it is ready for grazing. Together with the hay consumed, therefore, each cow requires somewhere about $2\frac{1}{2}$ acres of the Tunley grass land for her yearly main-enance. Cheese-making commences the first week in March, before which fresh butter alone is produced. The cows are not allowed to remain on the same pasture for more than four or five consecutive days.

Sheep.—100 breeding ewes have been hitherto purchased in October. They are cross-bred, but have a preponderance of Hampshire blood. Having been run with the ram in the month of August, they are bought in lamb. The flock is not allowed o be much on the grass land, except for a short time, about the ambing season. The ewes and lambs have, as a rule, been all ed and sold before the advent of the next year's purchase, the practice having been to draft them gradually off the green crops s they grew ripe. The lambs have generally been disposed of, herefore, from three to four months old; but for the future a new policy will be adopted, and they will be weaned at the beginning of June, and have their cake and corn gradually ncreased, until they are sold fat as yearlings off the roots. After he lambs are weaned, the ewes are pushed forward, and disposed f in the autumn when fat.

It is intended to increase the flock from 100 to 150 breeding wes.

Pigs.—Ten black Berkshire sows are kept. A white boar, f Duckering's breed, is used for crossing. About 120 fat pigs, he produce of the above, are turned off in the course of the ear. They are sold as they reach the weight of 10 score each, he value per pound decreasing after exceeding that size. The igs are kept in a feeding state from the time of their birth till old off. No straw is used for littering them; the floor of he piggery is paved with hard bricks, and by thorough cleanli-ess its use is dispensed with. The economizing of straw is n important matter, on account of the limited acreage of arable and in proportion to the large herd of dairy cows. Sawdust s sometimes used to supplement the straw for litter.

Fences, Roads, and General Neatness.—The outlay made by he tenant in removing old fences and levelling ditches, &c., n the pastures, has already been alluded to. The remaining ld Somersetshire hedges have had their banks much diminished, ut can never be made good. Quick-set hedges do not appear o thrive on this farm. The boundary along the main road a solidly-built lias-stone wall. The new fences across the astures are of strong wire, and present a neat appearance.

Stout wire rope, probably from the collieries, has been run through most of the old hedges adjoining or intersecting the grass fields, which would present formidable obstacles to sportsmen.

Ponds have been made and thoughtfully arranged to supply the grass fields, one pond usually being available for two fields. A good main road intersects the farm, and a by-lane bounds part of the western side; but the repair of these does not come within the province of the tenant. No other made roads have been formed, the farm being too straggling to arrange them; but general neatness is everywhere apparent, and could not well be excelled.

Manures and Food purchased.—The annual outlay in purchased foods, irrespective of that consumed by horses, amounts to the large sum of 600*l.*; this includes 15*l.* for grains for the milking cows, the rest being corn, linseed- and cotton-cakes.

Artificial manures, chiefly superphosphate, cost 22*l.* annually.

Cottages and Labour, and Permanent Improvement.—There are no cottages attached to the holding. The weekly wages for labourers now amounts to 15*s.*, the hours of labour being from 5.30 A.M. to 6 P.M. They have increased from 11*s.* per week in 1865. The workmen are allowed 1½ pint of cider per day, with a largely increased quantity in harvest.

Women are employed on the farm and for milking. Their hours are from 8 A.M. to 6 P.M., and the daily payment is 10*d.* Milking is paid for extra, at the rate of 6*d.* each time. Four women assist at this work.

The LABOUR BILL on the FARM during the last nine Years, showing an average for the four years, 1866, 1867, 1868, and 1869, when the weekly wage was 11*s.* and 12*s.*, of 25*s.* per acre; and for the five following years, during which time they rose to 15*s.* weekly (with liquor) of 30*s.* per acre, and an increase from 21*s.* 4*d.* per acre in 1866 to 32*s.* 6*d.* in 1874.

Year.	Cash paid to Men on Farm Account.			Hire of Threshing Machine.	Wages and keep of Dairymaid.	Total.		
	£	*s.*	*d.*	£	£	£	*s.*	*d.*
1866	177	19	3	5	27	209	19	3
1867	203	15	3	5	27	235	15	3
1868	257	9	4	5	27	289	9	4
1869	233	6	1	5	27	265	6	1
1870	237	13	7	5	27	269	13	7
1871	240	1	4	5	27	272	1	4
1872	255	7	1	5	27	287	7	1
1873	270	9	1	5	27	302	9	1
1874	290	8	7	5	27	322	8	7

The foregoing Table, respecting wages, is instructive; but it must be borne in mind that an annual outlay of from 50*l.* to 60*l.* per annum has been made on permanent improvements, which is included in the total sum paid for labour, and which for the future might be dispensed with.

The general management of the farm is unexceptionable, and the returns, both of dairy produce, as shown by Mr. Little's Report, which follows, as well as those derived from the other resources of the holding, are eminently satisfactory, and could only be obtained by a liberal and judicious management; and the Judges had much satisfaction in awarding Mr. Gibbons the first prize for dairy farms offered by the Society.

Notes on the Dairy Management of Tunley Farm. By E. LITTLE, of Lanhill, Chippenham.

It is to be regretted there was not more competition in this class in such an important district for making cheese. There were only three farms entered, viz., Mr. George Gibbons, Tunley Farm, Bath; Mr. Robert Alfred Day, Oubley, Bristol; Mr. Cornelius Collins, Orchard Leigh, Frome. One would have expected at least ten or twelve entries, more especially as the Committee of the Cheese Market, established at Frome three years since, have annually offered liberal prizes for the best dairies of cheese. One would have expected this to stimulate competition for prizes for the best managed farms, as well as for the best made cheese. Whether it is that the farm-houses and buildings in Somersetshire are somewhat behind the times, and the landlords in many instances will not improve them (although there are many exceptions), so as to hold out any inducement to the occupiers to exhibit their farms in public competition; or whether the farmers, as a rule, attend more particularly to the management of their dairy-produce than to that of the land from which it arises, we cannot say; from whatever cause it proceeds, the competition was very meagre, and barely sufficient to admit of the second prize being awarded. However, had the competition been larger, it is doubtful whether we should have seen any dairy farm in Somersetshire better managed than Mr. Gibbons's, both with regard to the land and to the process of cheese-making. The latter I shall now endeavour to describe; but at the outset I should mention that Mrs. Gibbons is a daughter of Mr. Harding, of Marksbury, whose name is celebrated throughout England not only for his own dairy, but for having written valuable papers on this subject (see vol. xxi.), and as having been engaged in giving instruction in other districts on the art of cheese-making. It will not be wondered at, then, that the process is carried on

in the most perfect order, it being the same, or very nearly so, as that adopted at Marksbury, the full details of which are well described by Mr. J. C. Morton, in his paper "On Cheese-making in Home Dairies and in Factories" (see this Journal, 2nd series, vol. xi., part I., page 272), that it would appear superfluous to repeat it here. The only difference in the manufacture is that a portion of the whey is heated for the "scald" by being placed in tin vessels and floated in the boiler until the temperature is increased to 130°, and then poured into the cowl to get the whole up to 100° Fahr., instead of hot water being let into a space around and below the cheese-tub, there being no apparatus of that kind used in Mr. Gibbons's dairy.

The cheese is made once a day. The evening's milk is put into the cheese-tub, and a portion into other vessels when the weather is too hot to allow of the whole quantity remaining together in the tub. The morning's milk is added. Part of the evening's milk having been previously skimmed, the cream and a portion of the milk are heated up to 100° Fahr. by being put into tin vessels and floated in the boiler; the warmed milk and cream are then poured into the tub to raise the whole to 80° or 82° Fahr. The rennet, made from the best Irish vells, is added at the rate of about half a pint to 100 gallons of milk; it takes about an hour to coagulate, when the curd is cut by a long knife, in lines through the whole depth, into squares of 3 or 4 inches. The curd is then broken up with the hand and the skimming-dish, and gently worked with the curd-breaker, which is made with four fingers of brass with wire worked across it. Great care is taken in this processs, so that the whey does not lose its colour. The curd is broken into small pieces about the size of cherry-stones. It takes fully half an hour to get it to the proper state. A portion of the whey is then drawn off and heated, by floating the vessels in the boiler, and is then returned to the tub to heat the mass to 100°. The mess is then stirred for half an hour by hand and skimming-dish, until the curd is reduced to separate pieces not larger than peas. When the whey has well settled, it is drawn off by a tap at the bottom of the tub (a fine zinc sieve being placed before the tub to prevent any curd from passing off); it runs away by a trough to the whey-house into vats, in which it remains until the following day, when it is skimmed, making butter of about half a pound per week per cow, or somewhat less. When the whey is drawn off and the curd has become tolerably dry, it is cut into several pieces, which are thrown one upon another, and left for some little time to thoroughly drain and get together, when it is cut again, and left a few minutes to cool; it will then turn slightly acid, but it must not become too much so. The curd is then broken up by hand into pieces,

about 3 inches square, and left to cool; when sufficiently cool, it is put into the vat and placed in the press for half an hour, after which it is taken out and passed through the curd-mill, and spread in a wooden vat or cooler of about 3 feet by 5 feet to cool and toughen. When the curd is sufficiently cool, 2 lbs. of salt are added to the cwt., and it is placed again in the vat and pressed, the pressure being equal to nearly one ton weight. It remains in the press till next morning, when the cloth is changed; a thin calico cloth is put on the cheese the second day; on the third or fourth day it is taken from the press to the cheese-room, and a strong linen bandage is laced tightly around it. It is turned daily for some little time, and less frequently as it ripens, three months is generally about the time for it to become marketable. The cheese-room is kept at a temperature of about 60° Fahr. by means of a stove in the room "*to ripen*" the cheese.

Mr. Gibbons's cheese has a wide reputation, having taken nearly thirty prizes in many counties at home, and it obtained the gold medal at the French Exhibition in 1865.

Mrs. Gibbons, as before stated, takes the superintendence of the cheese-making, and is assisted only by a girl, at 9*l.* per annum. The cost of making here contrasts favourably with any factory system, so far as actual out-of-pocket expenses are concerned. Three or four women are engaged to milk. They are paid 1*s.* per day for morning and evening.

The whey is used for feeding pigs. 200 or 300 qrs. of corn are purchased for fattening the pigs, which are usually bred on the farm. The whole of the drainage from the house-piggery and yards is conveyed to a tank in an adjoining field, which lies on the side of a hill. A cart is set on the lower side, a screw-plug is turned, and the sewage flows into the barrel, and is distributed over the poorer portion of the field. Its effects are very marked. It is also used for drilling the root crops grown on the farm.

Second Prize Farm.

Oubley Farm, near Bristol, occupied by Mr. Robert Alfred Day, to which the Judges awarded the Second Prize offered in the class of Dairy Farms, contains 24 acres of arable and 156 acres of pasture land.

Situation and Geology.—The farm lies 12 miles south of Bristol, and, with the exception of 29 acres of pasture on the Mendip range itself, rests at the base of the Mendip Hills. The lower land is on the new red marl, and the hill pasture upon the limestone shales.

Soil.—The bottom portion of the farm is a red loamy soil of a very retentive character, the upper part being much lighter in nature, and more of hill-pasture character. The subsoil of the lower farm is chiefly clay, but occasionally seams of gravel are found intersecting it.

Climate.—The climate is variable, and the rainfall excessive. The Mendips are extremely steep on the Oubley side, and the flat district below the farm is consequently much exposed to floods in the winter and in wet seasons.

Tenure.—The tenure is from year to year, commencing, for the most part, at Michaelmas, and terminable by a six months' notice to quit. A portion of the land, however, not originally taken with the holding, is held on the same terms from Christmas to Christmas, and another small section recently occupied, from Lady Day to Lady Day. The agreement admits of no tenant-right, but the payment of land and property-tax by the tenant is made a *sine quâ non.* The local customs are much the same as on Mr. Gibbons's farm.

House and Buildings.—The house and dairy premises are justly described in Mr. Little's accompanying Report, and may be characterised as being as bad as it is possible to conceive.

The buildings are also totally inadequate for the holding. They are stone erections, partly thatched and partly tiled, inconveniently arranged, and insufficient to give house room for the dairy cows and pigs. There is a small stable; cow-ties for about half the cows kept; a chaff-room fitted with a chaff-cutter and a pulper, worked by one-horse-power machinery; a cow-house converted into a piggery, over which is a meal store-room; an outhouse for preparing food for the pigs, into which the whey is pumped from the dairy by means of a force-pump; a carthouse, and a cider-room. The stackyard is at the back of the buildings, and has been extended and levelled at considerable expense by the tenant. The walled garden is behind the house, and the neatly stacked wood-piles and the orchard extend still further to the rear. The orchard produces on an average some 50 hogsheads of cider yearly. The overflow of the yards is conveyed across an occupation road by means of open wooden troughs into the meadow at the back of the buildings.

The farm is much scattered, and the fields are irregular, and in many instances detached.

Grass Land.—The grass land is not naturally very fertile; but the appearance of the pastures has been considerably improved by the removal of superfluous fences and irregularities, and the filling up of unnecessary ditches. Some under-drainage has also been done, the landlord charging a moderate interest on

the outlay, and the tenant doing the haulage. Much improvement remains to be effected, and there is every indication that thorough drainage would be the proper basis to start from.

The pastures now throw up rushes to a considerable extent, and the hedge-row elm-trees, which are rather numerous, have a dwarfed and starved appearance.

With the exception of two pastures contiguous to the premises, the grass land is grazed and mown every alternate year.

About 30 acres are top-dressed with farmyard-manure annually.

The Mendip pastures undergo the same treatment as the lowlands.

Arable Land.—The arable part of the farm consists of 24 acres, divided into small fields and intersected by large ditches. The usual course of cropping is:—

Beans,	Barley, or Wheat seeded,
Wheat,	Seeds mown,
Roots,	Seeds.

This rotation, however, is not very rigorously carried out. Like the pastures, part of the arable land has been imperfectly drained, and is still very wet. It is ploughed up in three-bout butts, and water-furrows are also cut to remove the surface-water into the open boundary ditches of the fields. Whether perfect under-drainage would obviate the necessity for these small high-backed lands and surface-water furrows, entirely or not, it is difficult to speculate upon; but the present conformation of the lands, the arrangement for the removal of surface-water, and the natural ditches, must do much to neutralize the effect of the under-drainage. Be this as it may, under any circumstances this tenacious soil would be most difficult to cultivate.

Beans.—Winter beans only are grown; they are sown early, and farmyard-manure is always ploughed in before drilling them.

Wheat.—The varieties grown are Nursery, Blue Ball, and April wheat. The autumn-sown sorts follow beans, and are drilled at the rate of about 2 bushels per acre towards the end of September. April wheat is sown towards the end of March instead of barley, which is not often sown. Three bushels of seed per acre is sown at this season.

Roots.—Mangolds and swedes are grown. The wheat stubbles are cleaned and cultivated directly after harvest, and the ground is then bouted up into ridges with a common plough, and left thus exposed for winter pulverization. In the spring, when sufficiently dry, it is worked down, then ridged up again, and farmyard-manure applied between the ridges, which are

afterwards split back to cover the manure. The ridges are somewhat more than 2 feet apart, and the seed is sown upon them with the liquid-manure drill, and 5 cwt. of bone superphosphate.

A few vetches are occasionally grown before swedes. They are either consumed by the working horses, or by the cattle on the pastures.

Seeds are sown on the surface with the spring cereals. A mixture of 10 lbs. of broad clover, 4 lbs. of white Dutch, 3 lbs. plantain, and 1 bushel of Italian rye-grass is used. The seeds are mown the first year, grazed the second, and broken up early and the land prepared for the succeeding crop.

Live Stock on Oubley Farm.

48 dairy cows.
8 two-year-old heifers.
10 yearling heifers.
1 old bull.
1 yearling bull.

Four working horses, one 2-year-old colt, and about 50 pigs of all sizes.

At the winter inspection we found the dairy cows all out, and the winter beans and wheat well put in. The following spring visit enabled us to see some very good and clean crops of beans, some very fair wheat, the mangolds well sown, and a few acres in course of preparation for swedes after vetches. The last of the vetches were being mown off, and a good crop had been removed. The dairy cows were out on the pastures, and looked all that could be desired, while the young stock were very promising.

Stock.—The dairy cows are Somersetshire Shorthorns. They have been carefully bred for their dairy qualifications, and have every appearance of being a fine herd of milking cows. They calve from the end of March to the beginning of May, and their calves are removed from them at a few days old and sold. About 10 heifer-calves remain with their mothers for nine or ten days, and are then reared by hand. These go to the bull at 15 months old, and replace the aged cows in the dairy as they are drafted out. The dairy cows are dried about ten weeks before calving. They are fed in the winter on a small quantity of roots, brewers' grains, a limited allowance of linseed-cake, with a little meal and chaff, and some hay. They do not come into the buildings in the winter until about calving, as there is not sufficient room for the whole of them.

The cows that are drafted are milked until they are sold, which is usually on the 18th of January, at Barnet Fair. They are well fed with cake, and go off in good store condition.

The dairy cows go out to grass permanently on the 1st of May, and receive no extraneous food, with the exception sometimes of a few vetches, until the following winter.

The heifer-calves are well cared for the first year, and afterwards depend upon the natural resources of the farm.

There are no sheep bred on the farm or bought in.

Pigs are fed up to 10 score, and 140 to 150 disposed of in the course of the year.

Horses are light, but active, and well adapted for the road-work required by a dairy-farmer in fetching or removing his produce.

The roads and fences are well cared for. The hedges, originally of a very rough character, have been trimmed well, and, without being cut low, are neatly kept. The ditches also are well cleaned out, and the outfalls of drains by no means neglected.

Manures and Food purchased.—The outlay in artificial manures is insignificant. That for corn and cake would amount to some 500*l*. per annum, the larger proportion being disbursed in meal for the feeding-pigs.

Cottages and Labour.—There are no cottages on the farm, and the rate of wages is 14*s*. per week, with 2 quarts of cider per day.

Of Mr. Day's management we cannot speak too highly. Under the most disadvantageous circumstances he produces very great results, and there is nothing about his farm that is not carried out in the most effective way. The same remark fairly applies also to Mrs. Day's internal management.

Notes on the Dairy Management at Oubley Farm. By E. Little, of Lanhill, Chippenham.

Mr. Day's farm was exhibited under peculiarly disadvantageous circumstances. In the first place, Oubley is an out-of-the-way farm, in an out-of-the-way part of Somersetshire; it is situated almost close under the north-west side of the Mendips. Sandford, on the Cheddar Valley line, is the nearest station, and is 8 miles distant. The road to it from the Bristol side in a wet season is impassable on foot, and is marked by graduated posts, to show the traveller the depth of the water he may have to pass through. In the second place, the farm is very scattered, there being only a few pasture fields near the house; and a portion of the pasture is situated on the top of the

Mendip Hills. The Judges will not easily forget their journey up the hill to reach it: the road was so steep that it was as much as a pair of horses could do to draw the empty waggonette up the hill; yet the milk at certain seasons of the year has to be brought from there, two miles distant, twice a-day. In the third place, the premises are exceedingly small, and very inconvenient for carrying on the business of the farm, more especially the house for the process of cheese-making from the produce of from 48 to 50 cows: it seems marvellous how any landlord in the present improving age can permit such poor buildings to remain, and his tenant to reside in such a house. There is not shelter for a score of animals in the yards. The whole of the buildings are as inconvenient as can well be imagined. The cider is kept in the barn, and what should be the "*hog-tub house*," for want of better storage. The house is very small; there are only two small rooms and the dairy, in which, to use the common expression, "there is not room to swing a cat."

In the dairy, with which we have most to do, there is hardly room to walk round the cheese-tub to perform the necessary operations. As to the cheese-loft, it is merely a small bedroom, in which, on our first inspection, there was a fine lot of 4 tons of cheese, the floor being supported by sundry pieces of timber. A fire was blazing in the grate to keep up the temperature, and at that time of the year was certainly an advantage to the whole house. The bedrooms are in close proximity to the cheese-loft, and in the warm summer weather the inmates must be overwhelmed with the smell of cheese in the sleeping apartments. Notwithstanding all these drawbacks, everything indoors and out was in good order, and the management as good as could be expected under such circumstances.

The cheese appeared to be of first-rate quality last year, the price averaging 80*s.* per cwt. Mrs. Day superintends the whole of the operations herself. The Cheddar system is adopted by Mrs. Day, and is rather different from the system reported as practised on Mr. Gibbons's farm. The morning's and evening's milk being put into the tub, and a portion of the latter heated so as to raise the whole to 80° Fahr., a little sour whey is used with the rennet. If the weather is not too warm, it stands an hour, or about that time, when coagulation takes place. The curd is then cut with a long thin knife and broken a little; it is afterwards allowed to settle for a short time, when a portion of the whey is dipped off, and heated to 140° Fahr. by floating on the boiler in tin vessels; it is then poured into the tub, and the breaking of the curd is completed. It is allowed to settle again; more whey is dipped off, and heated to 160° Fahr., and the process is repeated until the curd is raised to 100° Fahr.,

when it is stirred 20 minutes. The curd is next allowed to stay on the scald half an hour; the whey is then drawn off, and taken at once to the vault (not kept and skimmed), and used for feeding pigs. The curd is then cut, and put up in the centre of the tub in layers, in which state it is allowed to remain until it has turned a little acid. It is then broken into pieces, and placed in the press for half an hour. When taken out, it is put through the curd-mill, and laid in the cooler or vat until sufficiently cold. Salt is added, at the rate of 2 lbs. to the cwt.; and the curd is then put in the press, when it goes through the same process as has been described in the report on Mr. Gibbons's cheese-making, as to changing cloth bandages, turning, &c. The whey being taken out to the vault, and not "*set up*" and skimmed, there is no whey-butter made.

Mr. Day purchases store pigs, 20 to 40 at a time, and fattens them with purchased food—barley, beans, and Indian corn. The pigs are made about 10 score each when sold. From 140 to 150 are fattened during the year, consuming 300 to 400 sacks of corn.

Class III.—Farms not qualified to compete as Dairy or Hill Farms.

First Prize Farm.

This farm (Dillington, near Ilminster) is in the occupation of Mr. Obed Hosegood; it consists of 275 acres of pasture and 142 acres of arable land, and lies about a mile from the town of Ilminster in an easterly direction. It is situated partly on the Inferior Oolite, contiguous with its junction with the Upper Lias. This formation and the Middle Lias crop out, or closely underlie the soils, in this locality. The upper part of the arable land is of a yellowish sandy character, and is principally on the Inferior Oolite. Descending eastwards below the turnpike-road the Upper Lias becomes apparent, and the tenacity of the soil is increased. The lower grass land at the bottom of the park, lying towards the northern boundary, is heavier still, being of a strong loamy nature on the surface, and underlain with Marlstone, the Upper Lias probably having been denuded at this point. About 40 acres, running from east to west through the centre of the arable land, have been quarried, the stone being here found at a depth of from 4 to 6 inches. A small stream rising from a spring above the farm forms part of its boundary; and this, connected with a pond a short distance from the premises, is sufficient for the supply of water-power for chaff-cutting, pulping, grinding,

winnowing, &c. This brook runs some half-mile below the farm into the river Ile, which flows from Chard, past Ilminster, and joins the Parret above Longport.

The climate is mild, and forms a great contrast to Brendon Hill, being a fortnight to three weeks earlier. The grain-harvest is usually completed in this locality about the time of commencement there. Harvesting operations begin about the 1st of August. This district is generally supposed to be about a week later for the ingathering, as well as in the spring, than that of Taunton Dene.

The rainfall averages something like 32 inches, being about the same as at Bristol, where Dr. Burder's returns show an average, for the last twenty years, of 32·05 inches. Taunton would show rather less, last year's average totalling 29 inches against 35 in Bristol.

The tenure of the farm is a yearly tenancy from Lady Day, but the general custom of the estate is a twelve years' lease. The agreement provides for no hard-and-fast rotation; and there are no restrictions as to cropping, further than what may be implied by the requirement "to pursue a good system of husbandry." There is no tenant-right by agreement or by the custom of the country. Local custom here admits a right of pre-entry to an incoming-tenant to an average proportion of the land to sow with wheat in the autumn, either after mangolds, beans, or clover-ley. The out-going tenant pays the rent till Lady Day and receives no share of way-going crop. All produce must be consumed on the farm before Lady Day. The cost-price of young clover-seeds is allowed for, provided they have not been depastured after November 1st.

The house and buildings are snugly placed on the eastern side of the farm, surrounded by plantations and orchards. Most of the cottages are adjacent to the house, and with their gardens are within the area of the same shelter. The dairy premises are in the park pasture land and some distance from the residence. A yard with stalls at the home-buildings is, however, reserved for the cows. The house is of a superior character, and is partially surrounded by pleasure-grounds, the neatly kept and productive kitchen-garden being in the rear. The farm premises are well built, and in a good state of preservation. They consist of a double gable-ended building, formerly a flour-mill, which, with its machinery, was some years ago entirely gutted through fire. This mill was then worked by water-power, which is only now being reapplied. The basement contains a room for the water-wheel, calves' house, and cow-stable, with granary above, in which machinery is conveniently arranged for winnowing, chaff-cutting, grinding, and cake-crushing, and a connection is effected with a pulper for preparing mangolds, which

are mixed with chaff from a chaff-room below. Threshing, as well as some of these processes, has hitherto been performed by hired steam-power; but the new water-wheel (18 feet in diameter) in course of erection will in future do everything but the threshing of the grain. Adjoining this building is an exceedingly substantial barn, some 80 feet long and proportionately high, abutting upon the stack-yard. This is usually filled at harvest with the corn for first threshing, after which it is utilised as a straw bay. There are several sheltered yards, and stalls or boxes for, in all, about 70 head of cattle, as will be seen by the accompanying plan (see Fig. 6, p. 552). The stables and cider-room are nearer the house, and not visible on the plan.

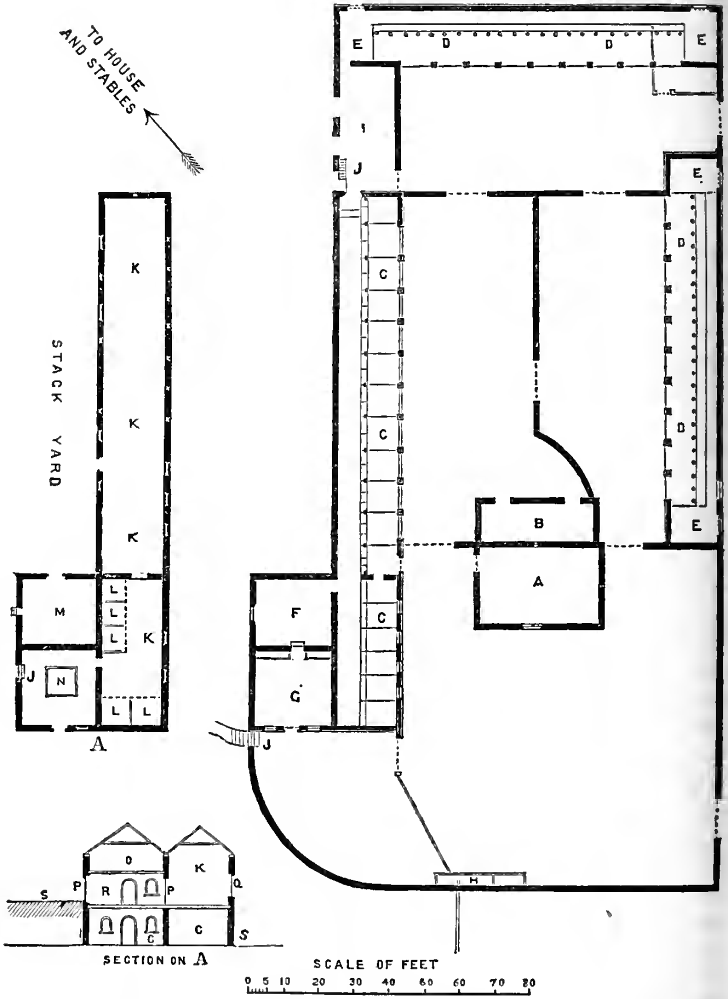
Grass Land.—The grass-land, consisting of 215 acres, is principally in the park of Mr. Vaughan Lee, M.P. The park portion proper is divided into large sections by neat, but somewhat light, iron fences; and the fields, in a northerly direction below the drive to the mansion, vary in size from 13 to 20 acres, and are divided by rather rough hedges and ditches. There is a good deal of ornamental timber upon this grass land, as may be supposed from its position.

The pasture lies north and west of the homestead, and is all together; one tillage field alone being intersected by it from the rest of the arable land, which is also otherwise contiguous, and is situated on the west and south of the premises. The bulk of the pasture is good grazing land. None of the park portion is kept for hay, and the practice adopted is to mow and graze the other parts alternately, or as they may be required. About 25 acres of the pasture is dressed every winter, at the rate of 10 loads per acre, with a compost consisting chiefly of road-scrapings and other accumulations, mixed with some lime, and occasionally salt, which is found to act very beneficially. No other manure, with the exception of the little farmyard-manure that may be in the compost-heap, has been used during the present tenancy upon the grass land. The quantity mown is usually about 50 acres, so that the fields from which hay is taken get manured every other year. The other pastures derive a benefit at the expense of the tillage, by the reduction of mangolds and swedes upon them in the winter months by the stock ewes and lambs, and also by the consumption of linseed- and cotton-cakes by the feeding-oxen in the summer.

The annexed map of the farm (Fig. 7, p. 553) will best illustrate its position with regard to the house and buildings, its general outline, and the comparative size and form of its enclosures.

Arable Land.—The land under tillage amounts altogether to 142 acres. The rotation of cropping adopted is—Wheat, swedes,

Fig. 6.—*Plan of Dillington Farm Premises.*



LARGE PLAN.

A. Straw house. B. Cow shed. F. Water-wheel house. G. Calves' house.
CC. Eighteen loose-boxes. D, D. Ties for 24 beasts. H. Watering trough. I. Root house.
E, E. Hay houses. J. Steps.

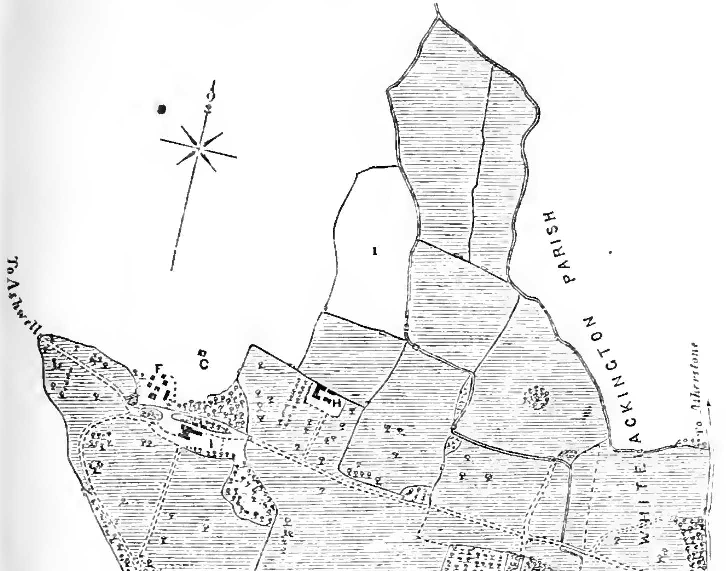
SMALLER PLAN A on a higher level than C, G, and F.

J. Steps down. KK. Barn. M. Chaff house.
K. Granary. L. Corn. N. Mill-stones.

SECTION ON A.

C. End of loose-boxes (see large plan). O. Mill-stones floor. PP. Doors.
G. Calves' house (see large plan). Q. Window. R. Mill floor.
K. Granary (see small plan). SS. Higher and Lower Ground level.

Fig. 7.—*Plan of Dillington Farm, in the Occupation of Mr. Hosegood.*



A. Mr. Hosegood's house and farm buildings.
B. Cottage and gardens.
C. Farm cottages.
D. Garden.
E. Cottages and gardens.
F. Stables and coach-house, Dillington Mansion.
G. Kitchen gardens, ditto.
H. Dairy house.
I. Dillington Mansion.

1. Trifolium, 5 acres; mangolds, 9 acres.
2. Trifolium cuts, 8 acres; clover, 11 acres.
3. Wheat, 7 acres.
4. Wheat, 18 acres; oats, 6 acres.
5. Wheat, 15 acres.
6. Wheat, 7 acres.
7. Clover, 10 acres.
8. Potatoes, 4 acres; rape, 7 acres; mangolds, 8 acres; cabbage, 5 acres.
9. Tares, 11 acres; being ploughed, 10 acres.

Note.—The grass land is tinted, the arable land left white.

mangolds, wheat, clover, wheat, turnips. The effect is the growth of a breadth of about—

60	acres	wheat	per annum.
60	,,	roots	,,
20	,,	clover	,,
2	,,	potatoes	,,
142	acres.		

One-third, or 20 acres, of the wheat comes after two green crops proper. Two-thirds, or 40 acres, after one ditto. The wheat course, prior to roots, is succeeded with intermediate green crops, with the exception of some half-dozen acres. Mangolds are preceded by rye, swedes by *Trifolium incarnatum*, turnips by vetches, and cabbage by mustard, or on the bare fallow portion of the stubbles. Sometimes even two catch crops are taken, as was the case this year with a very good piece of spring vetches, which was fed off in June, subsequent to mustard, and prior to common turnips, which took their proper place in the rotation. Mustard is also sometimes sown in the same way before trifolium. The seeding of the intermediate crops begins as soon after harvest as possible, which is usually completed about the 21st of August. The stubbles are first forked to remove the couch, and Bentalled, or scarified, when required, and the weeds burnt. The land is then ploughed as deeply as the soil of the different fields will admit, from 6 to 10 inches where possible.

Mustard is first put in at the rate of half-a-bushel per acre.

Trifolium incarnatum is sown with about 25 lbs. of seed per acre. The land is ploughed, and subsequently well rolled; and after sowing, sheep are driven over it for a considerable time, in order to secure thorough consolidation, otherwise it is very doubtful whether the plant will be established. It is seeded as early as possible, and is usually fed off with sheep. Occasionally, however, it is mown, and it is found to make excellent hay for horses, and to produce from 2 tons to 50 cwt. per acre.

Rye.—The land cropped with rye after wheat is followed by mangolds, the other portion of those roots coming after swedes. Rye is sown about 2 bushels per acre as near the 1st October as possible, the ground having previously been dressed with farmyard-manure, where practicable, before ploughing, and then folded over with sheep in order to get a firm seed-bed.

Vetches are first drilled about the commencement of October, at the rate of two bushels per acre, with a peck of winter oats. Other breadths follow at different times, in order to secure a succession of green food for feeding off with sheep in the summer.

The intermediate crops are chiefly fed on the land; they are not usually manured, the only exception being for rye prior to mangolds, in which case the application is simply anticipated a short time. The preparation for roots after the consumption of the before-mentioned crops is simple. As much of the land as possible is sown after one ploughing, farmyard-manure being turned in with the last earth. That only once ploughed is Cambridge rolled to retain the moisture, and close folded with sheep at the rate of 800 to 1000 per night per acre. It remains in this state till time to prepare for sowing, is then scarified about 3 inches deep, harrowed and rolled to a proper tilth, and then drilled. Better crops are insured when the ground is thus prepared than after several ploughings. When close folded with sheep no artificial manures are used.

Mangolds are sown partly after swedes, and partly after wheat followed by rye, as already described. After swedes they are never got in under two ploughings, and receive a dressing of about 15 cartloads of farmyard-manure per acre; while after rye (provided it has not been put in for that crop), as much as 25 loads is applied to the acre. The Yellow Globe variety of home growth is sown at the rate of 6 lb. per acre on the flat, as are the rest of the roots. The rows are about 18 inches wide, and the plants are set out 10 to 12 inches apart. Reeve's manure-drill is used; and 2 cwts. of Bernard and Lock's, or Odams's prepared bone-manure, and 5 bushels of soot per acre, mixed with a cartload of earth that has been saturated during the winter with the urine from the stables, are put in with the seed. Mr. Hosegood prefers the Yellow Globe mangold to the Long Red, and affirms he can grow 10 tons per acre more of the former. He should be no mean authority, having for five years successively carried off the premium for the best crop of mangolds within a radius of 20 miles of Taunton, with an average weight of 44 tons per acre, roots cleaned and tops cut.

In 1872	his mangold crop	weighed	64	tons	per acre.
„ 1873	„	„	60	„	„
„ 1874	„	„	35	„	„

Last year was the lightest crop ever grown by him, owing to the loss of plant by insects. The mangolds are not horse-hoed at all, the occupier having once tried it and found much mischief accrue. The other roots are sown about the same distance apart on the flat, with the same quantities and description of manures, and are singled at about 10 to 12 inches in the rows. The Purple-top swede and Green Ring turnip are the varieties grown.

Cabbages.—The plants are purchased at about 2*s.* per thousand,

and are planted out at 8*d*. for that number, in marked-out drills 20 inches square. The "Early Enfield Market" is first commenced with about Lady Day, and come in for feeding towards the beginning of July. Cattle cabbage planted the middle of April follow these in succession in the months of September and October. Forty bushels of soot per acre are applied when the cabbages are transplanted.

Wheat.—The white thick-set Essex is the sort usually sown. Rivett's is put on land liable to lodge crops, either from its nature or from exceptional treatment. The leys are ploughed about 4 inches deep, well rolled down, dragged, and then left for a month before sowing, which commences about the middle of November. Seven to 8 pecks of seed are drilled per acre; and afterwards, if the weather admits of it, sheep are constantly driven over the land to cause consolidation. Notwithstanding this, the ley wheat has a tendency to lose plant suddenly towards the end of January, and the practice then pursued is (weather permitting) to haul 3 cartloads of mangolds per diem upon the field, and place the couples there for a week, a mode of treatment that in every case is found to prove an effectual cure.

The sheep are allowed to run over all the lighter wheat-fields in the spring, the impression being that this treatment renders the plant less liable to go down, and to knuckle or become root-fallen after the formation of the ear. Four or 5 pecks only of seed is sown after mangolds, and the crop is usually superior to that succeeding seeds. All the wheat is hand-hoed and top-dressed in the spring with 3 cwt. of salt and 20 bushels of lime per acre. Top-dressing with nitrate of soda is disapproved of as having a tendency to throw too much straw, and to render the plant liable to red-rust and mildew.

Clovers are spring-sown in the cereals, the mixture consisting of,

14 lbs. Red clover.
4 lbs. Trefoil.
3 lbs. Alsike.
1 peck Devonshire rye-grass.

First Inspection, November 1874.—At their autumn inspection the Judges found a portion of the wheat sown, and well up. The swedes were being fed off by the sheep; for the season they were a very good crop, although they showed a disposition to be necky. The common turnips were looking remarkably well.

The stock also seemed to be thriving. The flock of ewes on the grass land were becoming heavy with lamb. The wether hoggs on the roots were very forward; while the rest of the young

sheep were in healthy condition. The cattle were all in the yards and buildings. The feeding-bullocks (20 or 30, fewer in number than are usually fattened) were a good lot, and the young stock were all in an improving state.

ACREAGE of ARABLE LAND under respective CROPS.

Number of Field on Map.	Acreage.	May 20th, 1875.	July 9th, 1875, or to succeed this Season.
1	9	Mangolds after rye	Mangolds.
	5	*Trifolium incarnatum* cut ..	Green Ring turnips.
2	8	" " "	Green Ring turnips.
	11	Clover	For turnips not yet ploughed.
3	7	Wheat	Wheat.
4	6	Oats	Oats.
	18	Wheat	Wheat.
5	16	"	"
6	7	"	"
7	10	Clover	Clover.
8	5	Cabbage	Not yet fed.
	4	Potatoes	Potatoes.
	7	Rape	Not yet fed.
	8	Mangolds	Mangolds.
9	10	Ploughed after winter vetches	Swedes.
	11	Spring vetches	Half swedes sown. Half for Green Ring turnips.
	142		

Total of Wheat .. .. 48 acres.
" Oats .. .. 6 "
" Clover .. .. 21 "
" Green crops and roots .. 67 "

At their second visit on the 20th May the Judges found the wheat all looking forward, with sufficiency of plant. That after mangolds was, however, somewhat deficient in colour. Some portions had been top-dressed with nitrate of soda, and these could readily be detected by the eye. The oats were good. The mangolds were clean and regular, but had been much checked by the fly and grub, aided, doubtless, by the inclemency of the spring. The *trifolium incarnatum* was partly cut, and turned out a heavy swathe; the other portion was good, and quite ready for feeding. The winter vetches had to a great extent been fed off, and in one instance a second growth was going through the same process again. The spring vetches were very heavy, and nearly ready for use; they were grown after mustard which had been previously fed. The cabbages, rape, and potatoes had made a fair start. One piece of clover was mown. The other field of 10 acres was most luxuriant, and was apparently overgrowing the flock of lambs that were grazing it.

The hay was making good progress, and the grass land was abundant with herbage. The cattle were all doing well. The same remark will apply to the sheep, with the exception of the weaned lambs on the clover, which was apparently too gross a pasture for them.

List of Stock on Dillington Farm.

First Inspection, November, 1874.		Second and Third Inspections, May 20th and July 9th, 1875.	
Dairy cows	21	Dairy cows	21
Yearling heifers	8	Heifers (going in)	3
Calves "	11	(3-year-old) oxen	22
Devon steers, fattening	11	Yearling heifers and steers	20
Shorthorn "	20	Feeding heifers	6
Shorthorn bull	1	Calves	15
		Shorthorn bull	1
Total	72	Total	88
Dorset horn ewes, lambing down	305	Stock ewes	301
Pur or wether hoggs	174	Off old ewes with Down tup ..	116
Ewe hoggs	184	Pur or wether lambs.	171
		Chilvers or ewe lambs	164
		Fattening sheep	50
		Rams, 3 Dorset Horns, 2 Downs ..	5
Total	663	Total	807
Working horses	8	Working horses	8

Management of Stock.—A system common to parts of the county is here carried out with respect to the dairy. The dairy, which consists of 21 cows, is let to a dairyman at 14*l.* per cow for the year, a proviso being made that if the 2-year-old heifers, which would number about 7, are brought in in lieu of more matured cows, a rebate is made, reducing the charge to 12*l.* 10*s.* per cow per annum. The calves belong to the dairyman, but must be reared for the owner, and be well kept on skimmed milk and beans; and at 3 to 3½ months (towards Midsummer) they are taken to at their value, which is from 3*l.* to 5*l.* each. The increased price realised for a well-looked-after calf acts as a stimulus to the dairyman to do justice to the rearing. Twenty acres of pasture and 20 acres of aftermath are allotted to the dairy by the owner on such portions of the grass lands as may be prepared for feeding or for hay. These fields are winter-fed by sheep during the months of November to January inclusive, before being handed over to the dairyman, and the dairy cows are usually turned out to grass on the 5th of

May. In the winter, for the months of December, January, and February, food is found by the owner in the straw-yard. Besides straw, an allowance of 2 lbs. of cotton and 2 lbs. of linseed-cake per day, with a little chaff, is made for each animal; and about 10 days before the cows drop their calves, they have a small quantity of hay in addition. After calving, which is proximated to the 1st of March, each cow is given 15 lbs. of pulped mangolds, mixed with one part of hay and one of chaff, which consists of two-thirds hay and one-third straw. With this is given 2 lbs. of bran, and 2 lbs. of meal or cotton-cake per day till they go to grass. The dairy term commences on Candlemas Day (February 2nd), and the rent is paid in advance. The grass land is drawn for the dairyman at this date, and given up by him in November, when the stock is brought into the yards; at the same time the turn-off cows are dried, and commence feeding. The heifers do not take their place until they calve the following March, so that the apparent low charge of 12*l.* 10*s.* per cow is quite counterbalanced. If 14*l.* per cow per year were paid, the old cows would be drafted at Christmas, and the 3-year-old heifers would succeed them in the dairy about the middle of February. The dairy cows are useful cross-breds, improved at the present time by a pure-bred Shorthorn bull being used. The draft cows are taken away the 1st of November, and fed in about three months to something approaching 10 score per quarter. The dairy cattle are under the management of the dairyman the whole of the year, food alone being provided by the owner. The dairyman feeds pigs, and is allotted a small run for them.

The cattle bred are the offspring of the dairy cows by a pure-bred Shorthorn, and are of a very useful character. When the calves are purchased from the dairyman about Midsummer, both steers and heifers remain housed for the summer, and are fed with the different successive green crops as they mature, and with 2 lbs. of mixed meal, consisting of beans, bran, oats, and oil-cake daily. In winter their meal is increased and given them mixed with chaff. They also get turnips, then swedes, and pulped mangolds and a little hay till they go out to grass about the 1st of May. Towards October the steers recommence turnips on the pastures and have a small allowance of hay, or, if wet, at once go into the boxes, and are put on $\frac{1}{2}$ cwt. of swedes with chaff, two-thirds straw and one-third hay, pulped roots, and 3 lbs. of meal, per diem; to this is added a little hay morning and evening. The meal is increased 1 lb. per month till they are sold, which is about the beginning of April following, when they are a little over 2 years old, and at which time they generally average from 8 to 9 score per quarter. The heifers are less

liberally treated on coming in after their first summer's run. They go to the bull so as to drop their calves from March to May, when they would be from 2 to $2\frac{1}{4}$ years old. They are then transferred to the dairy in place of the aged cows drafted for feeding. Eight or 9 heifers are bred, and about the same quantity of steers; most of the former go into the dairy, and the latter are made up to 20 by bought-in calves, and all treated alike. As a rule, 40 other more matured animals are also purchased and fattened, but this number was deficient by 30 head when we inspected the stock in November owing to the drought of last summer. At our second inspection we found the cattle in good grass, which was doing well, although it was stated that the pastures did not start till April 28th. In addition to the home-bred stock, the yearlings had been made up to 20 by 8 exceedingly good Shorthorn bullocks, 16 months old; and 22 3-year old Devon oxen, with a stain of Shorthorn blood in them, had also been recently secured; the former to go on for Christmas and the latter to finish off on the grass with their allowance of cake, consisting of 3 lbs. of mixed cotton, 2 lbs. of linseed, and 1 lb. of wheat-meal.

Sheep.—The sheep are of the Dorset Horn breed, and are true to type, and very good of their sort. The ewes drop their lambs about the end of December, and they are weaned the middle of March on swedes. They then go on to rye, where mangolds are carted to them, then to trifolium, and afterwards to clover and the succession crops, until the next season's swedes are available, when they are folded on them and have their roots cut. The pur or wether lambs commence with a $\frac{1}{4}$ lb. of cake and bran at weaning-time till October, when it is increased to $\frac{1}{2}$ lb., some cotton-cake being added; and from December till the time of finishing, at the end of January or beginning of February, they get 1 lb. of mixed corn and cake per day, in addition to hay, which is given to them from the time of their being folded on the roots.

When sold, they average about 74 lbs. per sheep in the wool. They are shorn as lambs. The turn-off ewes are drafted principally from age, and put to a Down ram (pure Sussex preferred, though Hampshire is not infrequently selected by some farmers) on the 12th of May, with the view to produce house-lamb for the early markets. They are either sold to dealers, who dispose of them at Weyhill Fair, or go direct to the feeders in the Isle of Wight and the home counties, and realise for this purpose 12*s.* per head more than if sold to the butcher. The stock ewes, after the lambs are weaned, run partly on the pastures and partly on close folds of the succession crops. They are rutted by a Dorset Horn ram in July, and begin to lamb in December. The

double couples are allowed 1 lb. of mixed cake per head per diem till the lambs are weaned, and hay is given in wet weather. After lambing they get about equal quantities of mangolds and turnips or swedes, the former being hauled on the pastures. The Upper Park (77 acres) is drawn on September 10th, and preserved for ewes and lambs, the ewes being hurdled in, and the lambs running forward on the young grass through lamb-hurdles. The flock is clipped about the end of May, and fleeces average for ewes $5\frac{1}{2}$ lbs. and lambs $2\frac{3}{4}$ lbs. About 100 hoggs or off-ewes are bought-in in April, and fed off in the course of the summer after shearing. The Dorsets are thought to be hardy, are good nurses, and well adapted for close folding.

Fences, Roads, and General Neatness.—The turnpike-road intersects the arable part of the farm, and the park-drive runs a long distance through the grass land, so that very little is necessary on Mr. Hosegood's part in keeping up roads. The fences are principally quick, and neatly banked up; they are closely trimmed along the turnpike-road and between the arable fields, but, being badly formed, have a tendency to be open at the bottom. The hedges in the lower meadows are rough. The general neatness of every portion of the farm is unexceptionable.

Manures, &c.—Seven years' average of manures per annum:

Salt, 20*l.*; lime, 20*l.*; soot, 20*l.* . . .	= 60*l.*
Superphosphate of lime . } Nitrate of soda . . . }	=108*l.*

Food.—Seven years' average of food purchased is equal to 502*l.* 13*s.* per annum, beginning with 400*l.*, and increasing to 750*l.* a-year. The relative cheapness of the different descriptions of corn guides Mr. Hosegood in his selection and method of mixing, but he prefers a combination of maize, beans, barley, cotton- and oil-cake, bran and lentils, and peas. This year 600 bushels of home-grown wheat and foreign barley have been consumed.

Cottages, Labour, and Wages.—There are 10 cottages let with the farm, and they are all entirely under Mr. Hosegood's control, which he considers necessary to enable him, in any way successfully, to carry out such a system of husbandry as he pursues. They are principally neatly thatched, and are better than the average of the county. Most of them contain five rooms, and they have good gardens. The rents are 1*s.* per week. Wages are a good deal supplemented by perquisites, both on this farm and throughout the district. Mr. Hosegood advocates payment in coin instead of giving cider, and has proposed in its place an additional payment of 1*s.* 6*d.* per week, but up to the present

time his labourers have declined accepting it. The wages of a shepherd or carter are:—

Cash	12*s.* 0*d.*
Cider (valued) . . .	1*s.* 6*d.*
Rent	1*s.* 0*d.*
Potatoes ($\frac{1}{4}$ acre) . .	1*s.* 0*d.* = 15*s.* 6*d.* per week.

Shepherd's payment by results in the lambing season, are 6*d.* for each double lamb, and 1*s.* per score on singles living June 1st. This would add to his wages an average of 1*s.* per week per annum. Carters get also in addition to the above, if they work through the summer:—1 ton of coal and 1*l.*; being equal to an average of 1*s.* per week per annum. The above makes an average of 16*s.* 6*d.* per week; but the lowness of the estimate of rent of cottages would further augment the value of the weekly earnings. Then the potato-ground, well cultivated and manured, and the potatoes carted home, producing a result equivalent to 10*l.* a-year, must be a valuable return to a working man for his seed and labour. The system of piece-work is carried out as far as it practicably can be: thus, winter hedging, ditching, and reed-making are performed on this principle; and in summer, mangold-hoeing twice by hand (the whole of the ground being cut between the rows, and setting out from 10 to 12 inches apart) is worked on the same system, and costs 13*s.* per acre; swede and turnip singling, and afterwards cleaning once, costs 9*s.*; pulling mangolds, cutting off tops, and filling carts, 8*s.* per acre. This last seems remarkably low considering the huge crops grown. Hay-mowing was formerly contracted for at 3*s.* 6*d.* per acre, but now is done with a grass-mower. The plan hitherto adopted for securing the harvest has been to reap half the wheat (that laid, or the heaviest being selected) with hooks at 8*s.* to 9*s.* per acre, for cutting, binding, and stooking. The remaining portion has been cut by day-work with a 1-horse manual-delivery reaper, the carters and odd men and boys assisting; the men having an allowance of 1*s.*, and the boys 6*d.*, extra per day. This year a self-raker will be used, and 6*s.* per acre given for cutting and stooking.

Ordinary labourers are paid 1*s.* per week less than the stock-men. 1$\frac{1}{2}$ quart of cider is allowed for each man per day in the winter months, and 2 quarts in the summer, the quantity being doubled in the hay and corn harvests. The hours of labour are from 7 A.M. till 5 P.M. for the winter, and from 6 A.M. to 6 P.M. for the summer, with 1$\frac{1}{2}$ hour's interval for meals. The annual outlay on the farm in labour, inclusive of perquisites, may be estimated at 600*l.*, or 33*s.* per acre.

The cider is made on the premises. The two orchards produce an average return of 100 hogsheads, and half this quantity is re-

quired for home consumption. Details respecting the manufacture and preservation of cider, by Mr. Clement Cadle, will be found in this Journal, Vol. xxv., Part I., page 76.

Book-keeping.—The accounts are clearly and accurately kept. A capital account shows the gross value of the live and dead stock year by year. A ledger, with divisional headings, allows the returns from each description of stock or produce to be ascertained, and a granary account enables the different sorts of stock to be debited with the respective quantities of corn or cake allowed them. A rough day-book is the foundation upon which the other books are based.

The third Inspection took place on July 9th. All the wheat in fields No. 3, part of No. 4, and in Nos. 5 and 6 was regular, good in the head, and only slightly attacked by red-rust. The crop had the appearance of being productive throughout. The portion top-dressed with nitrate of soda in the spring did not appear to have derived any benefit from the application. The oats on part of field No. 4 were very long in the straw and luxuriant. If not so heavy as to be badly laid in the recent storms they would produce a very profitable return. Field No. 2 was being prepared for common turnips, the *trifolium incarnatum* and clover having been mown and subsequently grazed. In field No. 10 the clover was still being grazed, and was a rich and abundant pasture. The 9 acres of mangolds in field No. 1 were very forward, regular, and clean, and there was every prospect of a very heavy crop. The other part of this field had, a day or two previously, been sown with Green Ring turnips after trifolium mown that had been made into hay. The fallow was clean and well cultivated, and a good tilth of soil secured for the seed. The mangolds in field No. 8 were not quite so regular as the last; but were forward, and likely to produce a large crop. The remaining crops growing on field No. 8 were—4 acres of potatoes, which appeared to be rather closely planted and superabundant in the top; 5 acres of cabbages, which were most creditable to any grower, being of the utmost regularity, all well developed, and the earlier sort ready for consumption; and 7 acres of magnificent rape.

It was intended to bring the lambs to the rape and cabbages a few days after the inspection, on the completion of the spring vetches in field No. 9, which would then be sown with Green Ring turnips. The bulk of field No. 9 had already been sown with swedes, which were well up. The stock were doing well. Two or three of the Devon oxen fattening on the grass had been disposed of, and the rest were shortly to follow. The off-ewes had all been rutted, and the stock ewes were with the Dorset Horn

rams, and fast going. The hay was nearly all harvested, and here as elsewhere had been very troublesome and protracted in the getting.

A brief consideration will bring to our minds the following facts:—

That this farm of 375 acres produces yearly from dairy, say	4 to 5 tons of cheese.
From cattle bred and fed	6 tons of butcher's meat.
" " bought-in	23 " "
" sheep bred and fed	5 to 6 tons "
" " bought-in	$1\frac{1}{2}$ to 2 " "
" " sold for early lambing, an equivalent to, say	5 " "
" wheat, estimating the crops to turn out fairly, and taking an average of acreage under the crop on an average return	308 quarters.
" oats	20 to 30 quarters.
" potatoes	6 to 8 tons.

What deductions can we draw from these results?

That judicious and liberal management will produce eminently satisfactory results.

That high farming is conducive to the interests not only of all connected with the land but of the public also. We see this exemplified in the results embodied above.

In the first place, Mr. Hosegood requires permanent residential labour to a no less extent than is provided for by the ten comfortable cottages on the farm, and this must be a boon to the occupants.

In the second, we see no reason to doubt that the large returns produced from the liberal outlay resorted to must be profitable to the occupier. The high state of fertility of the soil, due to liberal treatment and good cultivation, irrespective of unexhausted value of manures and feeding stuffs, must also enhance the value of the holding to the owner.

And it is a self-evident fact, that the far greater than average returns here produced are a substantial boon to the general consumer.

To Mr. Hosegood's energy and enterprise these satisfactory results are no doubt mainly due; but it is only fair to state that the bulk of the management has for some time past been in the hands of Mr. Obed Hosegood, jun., his eldest son, who, though young in years, has proved himself systematic and experienced in superintending and conducting the operations of the farm: and it is with satisfaction we find that the position taken by the farm in the recent competition is about to be acknowledged by Mr. Vaughan Lee, M.P., the owner, in the presentation of a piece of plate to his excellent tenant in commemoration of the event.

Second Prize Farm.

Capton Farm, near Williton, occupied by Mr. Alfred Bowerman, to which the Judges awarded the Second Prize in Class III., comprises 182 acres of arable land and 83 acres of pasture, making a total of 265 acres.

Position and Geology.—Mr. Bowerman's farm lies about two miles south of Williton, which is within a short distance of Watchet, on the Bristol Channel. It is situated on high ground on the west of the Quantock Hills, and adjacent to the Western Hill district proper. It may be described as being equidistant some two miles from the base of the Quantocks and the end of Brendon Hill, which runs at right angles to that range. The land undulates considerably. A portion which is all arable is three-quarters of a mile distant from the homestead, and is of a heavier nature than the remainder of the farm. It is a strong loam, the marl being to some extent intermixed with the lighter sand of the new red sandstone, upon which formation the farm rests. Most of the other land is a sandy loam.

Climate.—The climate is tolerably good, but facing north to north-east towards the Bristol Channel the occupation is somewhat subject to north-easterly gales, which at times prove damaging to the orchard and crops.

The district is not so early as Taunton Vale by ten days; and the rainfall is not so great as in the neighbourhod of Bristol and Ilminster, the heights of Brendon and the Quantocks probably attracting and arresting many of the showers. Mr. White, of Williton, has kindly furnished the results of his registration for the past two and a half-years, which show the average rainfall at that place to have been about 23 inches for the year.

Tenure and Local Customs.—The farm is held on a 14 years' lease, which commenced in 1870. Mr. Bowerman's parents previously occupied it; their tenancy having commenced in the year 1850. There is no tenant-right by custom or covenant. The provisions of the lease are of an obsolete character, but would to some extent accord with the existing local customs of the neighbourhood. The tenancy commences at Michaelmas. The incoming tenant has a right of pre-entry any time subsequent to Christmas. He can sow the proportion of land to be laid down with young seeds, cultivate that for root crops and sow it, throw up farmyard-manure in the yards, and apply it on the clovers for wheat.

The outgoing tenant may retain a portion of the buildings for threshing his grain, and for consuming hay and straw, until the Lady Day succeeding the expiration of the tenancy, or he can dispose of the same to the incomer at consuming price. All the

farmyard-manure is left on the premises for the benefit of the incoming tenant.

House and Buildings.—The house is in the village of Capton, towards the lower end of the holding; and is sufficiently large for the farm. The buildings adjoin; they are ancient, and not particularly well arranged; but they have been improved and made the most of by the present occupier, who since the commencement of his tenancy has expended 300*l.* on the premises in building, troughing, conveyance and arrangement of water supply, drainage of yards, &c., the materials for these works having all been found by him. The cattle are supplied with water in the stalls in conveniently placed small iron drinking-cisterns. The supply of water is continuous, being regulated by ball-cocks in the larger tanks erected for the stock in the yards, and these derive their complement from the drainage of the land above the road.

The overflow is conveyed, together with the rest of the surplus water from the roofs and the yards, by means of a 9-inch pipe into the meadow on the west of the premises, where it is disposed of by gravitation, the steepness of the slope of the field facilitating and perfecting the process. A range of open cattle-sheds has been built by the occupier. A slate roof covers it, as also the barn and adjoining linhay. The rest of the building is thatched. There are altogether four yards, and stalls sufficient to accommodate about thirty head of cattle.

The chaff-cutting, pulping, and corn-crushing machinery are tolerably conveniently arranged with a view to the distribution of food to the yards. The pulping is principally done by horse-power, and the threshing, winnowing, chaff-cutting, and grinding by a hired portable steam-engine and threshing-machine.

There are two orchards of nearly 9 acres extent, which produce on an average 100 hogsheads of cider per annum. Both are well kept; but the one is so scientifically and perfectly planted, that true lines of trees meet the eye from whichever direction it may look (see Fig. 8, opposite).

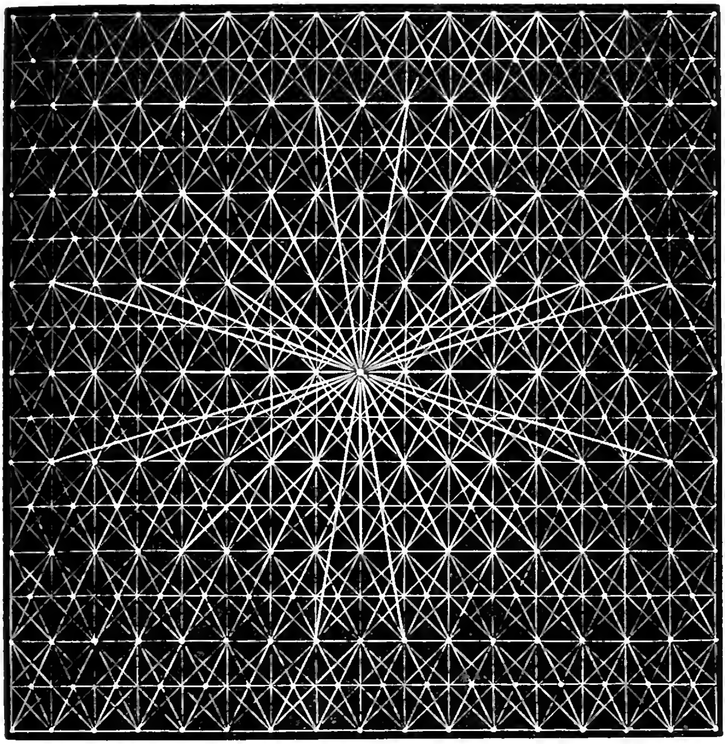
The appended plan of the farm (Fig. 9, p. 568) will show its relative position to the premises, and the alterations that have been carried out.

Grass Land.—About 20 acres of pasture land are manured every year with compost of the usual description, or otherwise with dissolved bones and a little nitrate of soda, at a cost of from 21*s.* to 25*s.* per acre.

A good deal of cake and corn is fed upon the other portions of the grazing land by the sheep in the summer. The pastures are not mown.

The meadows are annually manured with compost, or top-dressed like the pastures, unless any portion has been extra folded with sheep. Exception must be made, however, to some

Fig. 8.—*Plan of Mr. Bowerman's Orchard, showing the method of planting the Trees in rows 21 feet apart.*

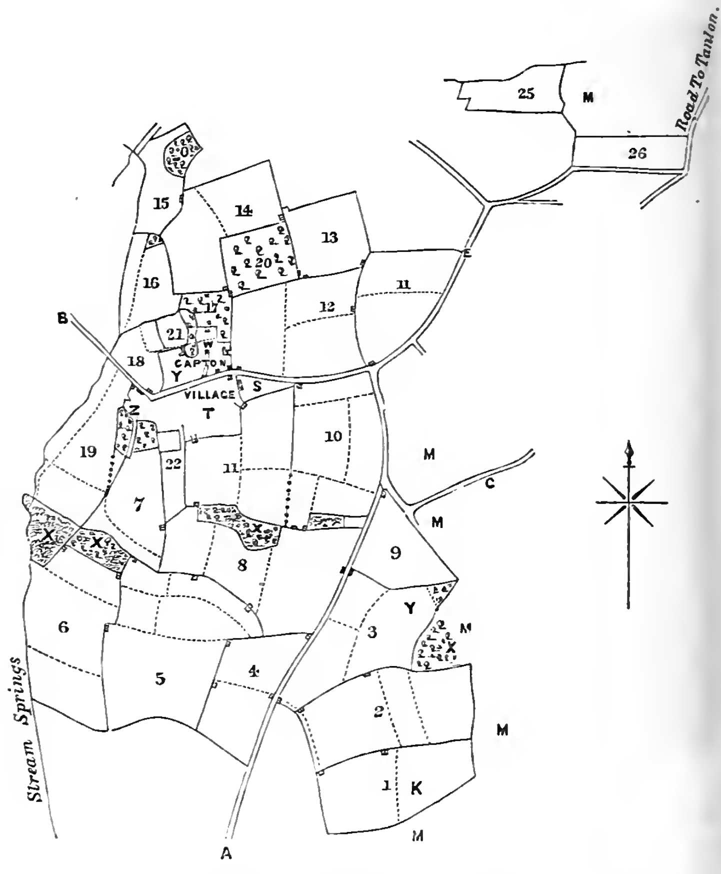


20 acres of meadows that can be subjected to the action of water. These are not arranged on the system of the regular water-meadows of Somersetshire, but are flooded from the higher ground by the diversion of a small brook that bounds the one side of the farm. Water is let on after heavy rains at intervals throughout the winter. At the time of drawing for mowing, which is as late as the second and sometimes the third week in April, they have four days' wetting, and this is repeated ten days later, after which nothing is done until the hay is removed. Hay is usually cut about Midsummer, and when carried the ground is again flushed for a couple of days.

Arable Land.—The four-course system is pursued, with variations in the intermediate cropping, and change of description of roots and seeds on the same fields as the alternations occur. The rigid rotation should be:—

Wheat,	Barley,
Roots,	Seeds;

Fig. 9.—*Plan of Capton Farm, in the occupation of Mr. Bowerman.*



The dotted lines show the old fences now removed; the solid lines show the old fences retained; and the beaded lines new fences substituted.

but spring-wheat is sometimes substituted for barley, while occasionally the seeds are laid down with rape or spring vetches, instead of a grain-crop—the invariable practice of the Hill district farmers as already described.

No undeviating rule exists as to the acreage of wheat-stubble, upon which vetches or other intermediate crops are sown. The quantity varies from a quarter to half the course: that is, from 12 to 24 acres. Part of the vetches are generally drilled in the spring, in order to continue the supply of fresh green food as long as possible into the summer. The soil, being of a sandy character, is very difficult to keep free from couch, especially in

wet seasons, and hence the indisposition to rely too much on catch-crops, it being essential to thoroughly scarify the land, and eradicate weeds before putting in vetches. If the fallows are not carefully prepared, the chance of a failure of the turnip crop is very great; and as Mr. Bowerman considers a good root crop the basis upon which the successful growth of his grain crops depends, he hesitates to stake too much on the growth of intermediate crops. After an early harvest in a dry season mustard and stubble turnips have been sown with success: the former having been fed off with sheep and followed by swedes, and the latter kept till spring for the couples, and ultimately put to common turnips. As much autumn cultivation is accomplished as possible, and, after cleaning, where practicable, the land is ploughed 9 inches deep.

Mangolds.—A breadth of 3 acres only is grown, the land being considered too light, and the crop too exhaustive for its extensive cultivation. After autumn cleaning and ploughing, farmyard-manure is applied at the rate of 16 tons per acre, and ploughed in. The Yellow Globe variety is grown, being sown about the middle of April, at the rate of 5 to 6 lbs. per acre, on the flat, and at a distance of about 20 inches between the rows. From 4 to 5 cwt. of superphosphate is sown with the seed, at a cost of 35*s.* per acre. The plants are Dutch hand-hoed between the rows, horse-hoed once, singled out 15 to 18 inches apart, and the cultivation is afterwards completed by hand-cleaning. The roots are generally taken up in October, and all are removed from the land. Mangolds are never grown on the same land more frequently than once in eight years. Sometimes $\frac{3}{4}$ cwt. of nitrate of soda and 3 cwt. of pollards are scuffled in by horse-hoe.

Swedes are generally grown after wheat, without a previous intermediate crop. The land is worked down fine in the spring after cross ploughing, to allow the weeds to start, and after their removal it is dressed with 14 tons of good rotten dung on the surface, and again ploughed and worked, so as to thoroughly intermix the manure with the soil. Ultimately the ground is usually ploughed a fourth time before sowing, although this is occasionally dispensed with, and cultivation suffices; ploughing is, however, preferred, excepting in very wet seasons. The thorough intermixture of the farmyard-manure with the soil is thought to be very beneficial. Improved Purple-top swedes are sown on the flat at a distance of 16 inches apart, and the plants are set out 10 to 12 inches from one another: 4 to 5 cwt. of superphosphate is applied per acre, at a cost of 35*s.* Sowing is deferred till the 17th to the 24th of June, as an earlier date is found to render the plants liable to mildew. The horse-hoe is seldom used for cleaning, the distance from row to row being

so narrow. Dutch hoeing between the rows, bunching, and singling, cost about 8*s.* 6*d.* Common turnips follow vetches, and are sown from the beginning to the middle of July. The previous cultivation is similar to that for swedes, excepting that there is no farmyard-manure applied. This is compensated for by feeding the previously grown crop of vetches off by sheep with cake and corn. The Green Ring and Tankard varieties are the sorts selected for growth. About a twelfth of the roots (both swedes and common turnips) are removed to the buildings in the winter, and the remainder consumed on the land by sheep.

Barley follows roots. As the swedes and turnips are fed off in the winter, the land is closely cultivated up in order to prevent rain-washing, and is ploughed when sufficiently dry. It is either again cultivated or ploughed a second time, and the barley is commenced to be drilled about the middle of March, and finished towards the second week in April. Hallett's Pedigree has been sown the past two years at the rate of 2 bushels per acre. Top-dressing has this year been resorted to, $\frac{3}{4}$ cwt. of nitrate of soda and $1\frac{1}{2}$ cwt. of concentrated bone and bone-superphosphate having been applied, at a cost of 1*l.* 1*s.* per acre, the second week in April.

Clovers are sown with the barley or spring wheat. They take their place in the rotation every fourth year, and the mixtures are altered, so that the same varieties shall not recur more frequently than once in eight years at least, and generally not more frequently than once in twelve years. Thus this year the wheat is seeded with the following mixture:

16 lbs. of broad clover,
2 lbs. of white Dutch,
1 bushel of Italian rye-grass per acre.

In one piece of barley:

10 lbs. of white Dutch,
4 lbs. of trefoil,
$\frac{1}{2}$ bushel of Devon Ever-grass per acre.

Another field was seeded out with

13 lbs. of broad clover,
4 lbs. of white Dutch,
2 lbs. of trefoil,
1 bushel of Italian rye-grass per acre;

while a fourth, which, however, was only put down for spring grazing, consisted of 16 lbs. of trefoil, with 1 bushel of Italian rye-grass.

About 15 acres of the young clovers are annually manured in

the spring after first feeding off. Twelve tons of well-prepared farmyard-manure is applied to the acre.

Wheat is sown on the clover-leys, which are ploughed in October. The sowing is usually completed towards the middle of November. A light dressing of lime and 3 cwt. of salt are sometimes ploughed in on the unmanured part; but more reliance is placed upon top-dressing in the spring, which is the invariable practice pursued in this neighbourhood, and which, Mr. Bowerman asserts, pays in the increased production; it does not subject the plant to blight or rust under his system of farming, and is not exhaustive. The thick-set Essex, as in most parts of Somersetshire, is here grown, and about 7 pecks per acre of seed is sown. The wheat this year was all top-dressed twice, at an interval of three weeks; the first time in March, the second in April: $\frac{1}{2}$ cwt. of nitrate of soda, $\frac{1}{2}$ cwt. of superphosphate, and $\frac{1}{2}$ cwt. of Bernard and Lock's concentrated manure, are put on at each application, making a total heavy top-dressing of

1 cwt. of nitrate of soda,
2 cwt. of superphosphate,

at a cost of 1*l*. 2*s*. 6*d*. per acre.

Spring wheat after turnips received a dressing of the same manures, equivalent to a cost of 17*s*. 6*d*. per acre.

At their first inspection in November, the Judges found the autumn wheat up and doing well. The swedes were being fed off with sheep: they were a fair crop, but, from being close in the rows and set out narrow, were not so large as they might otherwise have been. The dryness of the season of 1874 was the reason assigned by Mr. Bowerman for leaving them so close together; his idea being that the lateness of the rainfall would not give time for extended growth before winter. The turnip-land was clean and well cultivated, and the common turnips very good. The stock was all doing well; but there had been considerable mortality amongst the lambs previous to our visit, owing to the prevalence of husk and scour produced by the presence of the parasite called *Strongylus filaria*.

On the second visit, in May, the wheat and barley were found looking very well. The mangolds were forward, and the land was clean and well cultivated, as also was that preparing for the other roots. The winter vetches, which were heavy, were rather later than in the vales, and were being folded with sheep. The spring vetches were equally good, but of course more backward. The clovers were thick and luxuriant. The 2-year-old seeds had been preserved for mowing, and yielded an exceedingly heavy crop. The sheep were on the vetches and clovers,

and the cattle on the pastures, and all appeared to be doing well.

ACREAGE of ARABLE LAND under respective CROPS this Year.

Number of Field on Map.	Acreage.	May 19th, 1875.	July 10th, 1875, or to follow.
1	14	Seeds	Seeds.
2	18	Barley, clovered	Barley, clovered.
3	14	Wheat, clovered	Wheat, clovered.
4	10	Half spring vetches, clovered Half rape, clovered	Half spring vetches, clovered. Half rape, clovered.
6	17	Fallow	Common turnips.
7	8	Mangolds .. .. Vetches	Mangolds. White tankard turnips.
8	19	Fallow	Swedes.
10	17	Seeds	Seeds.
11	14	Spring vetches and Italian rye-grass, seeds having failed	Spring vetches and Italian rye-grass.
11A	13	Second year's seeds	Second year's seeds.
12	17	Wheat	Wheat.
13	8	Wheat	Wheat.
14	13	Barley seeded for breaking up for turnips	Barley seeded for breaking up for turnips.
Total	182		

	39	acres of wheat.
	44	„ roots.
	31	„ barley.
	44	„ clover.
	24	„ spring vetches and rape seeded.
Total ..	182	

On analysing the respective acreage of the growing crops it will be observed that the proper proportion of cereals is deficient. This is attributable to the fact of 10 acres having been seeded down with rape on a field unsuited to barley, and a long distance from the homestead, and from 13 acres of clovers having been left a second year on account of the failure of 14 acres of seeds, which had been resown with spring vetches and Italian rye-grass, and which will come to wheat in its proper rotation. The apparent excess of land seeded this year, namely 55 acres, is due to 13 acres having been laid down with Italian rye-grass and trefoil for spring keep, to be afterwards broken up for common turnips.

These slight inequalities in the acreage under each course are in favour of the growth of green crops, with its concomitant advantages of increased fertility to the land, and large production of beef and mutton.

STOCK ON CAPTON FARM.

November, 1874.		May 19th and July, 1875.	
CATTLE.		**CATTLE.**	
Cows and calves	10	Milking cows	10
2-year old heifers in-calf	4	Cows and calves	4
Yearlings (steers and heifers) ..	16	Yearlings off (steers and heifers)	13
Fattening cows	6	Heifers in-calf	3
2-year-old steers	4	Fattening steers	6
Calves	10	Calves	15
Yearling bull	1	Bulls	2
Total	51	Total	53
SHEEP.		**SHEEP.**	
Breeding ewes	200	Stock ewes (and 216 lambs) ..	170
Wether lambs	70	Draft ewes (and 10 lambs)	9
Ewe lambs	100	Yearling ewes	82
Cull ewes	10	Rams (all ages)	26
Rams (all ages)	26		
PIGS.		**PIGS.**	
Sow and pigs	1	Sow and pigs	1
		Young sows	3
		Feeding pigs	7
HORSES.		**HORSES.**	
Working horses	8	Working horses	8
Colts rising 3 years, sometimes at work	2	Colts ditto, sometimes	2
Hacks and colts	7	Hacks and colts	7
Brood mare	1	Brood mare	1

Cattle.—The herd of cattle is of the pure Devon breed. The calves are dropped in the winter, beginning in November, and are weaned at three months old, when their mothers go into the dairy. Dairying is not here made a speciality. The cows are not let separately to a dairyman, neither is any cheese made, the farm being unsuitable for its production. The cream is scalded in the Devonshire manner and made into butter. The calves are allowed $\frac{1}{4}$ lb. of cake and meal when weaned, and run out their first summer. On coming into the yards again the steers have the corn increased to 4 lbs. each with roots, and they are brought out fat at two years old at an average weight of 8 scores per quarter. The heifers go to the bull under two years old, and take their place in the dairy as the older cows are fatted out, the latter making 10 scores per quarter. Most of the roots given to the cattle are pulped, and the allowance of cake and corn is increased up to 8 lbs. for finishing the feeding stock, and for

the milch cows in the winter. An admixture of different kinds of corn is used with the cake for feeding.

Sheep.—The sheep are Improved Devon Long-wools, and the flock is of an uniform and useful character. With continued careful exercise of judgment Mr. Bowerman will, we think, in a few years, take a high place among his contemporary breeders. The ewes lamb in February, and the lambs are weaned at the latter end of May, and at once put on $\frac{1}{4}$ lb. each of linseed-cake and corn. They have the first run of the vetches, and are generally changed on clovers, rape, or pastures daily until the turnips are ready. The sexes are then divided. The rams and wethers are from this time better cared for, and precede the rest of the flock in the folds. The wethers are finished on the swedes in April, their corn being gradually increased up to 1 lb. per sheep each day. Some are usually sold in the wool in February, and the rest are clipped. They make from 20 lbs. to 22 lbs. per quarter in weight. The rams are carried on till the following June, and then sold or let by auction. The ewe lambs follow the feeding-sheep, and have a small piece of fresh fold daily allotted them. Their allowance of cake is increased to $\frac{1}{2}$ lb. each per diem till they go off the roots, and they become incorporated with the flock the following summer. The draft ewes are sold off fat as soon as possible after weaning, and the barrens often go with the fat wethers, as was the case this year. The stock ewes run the orchards, and pick up after the lambs on the vetches, clovers, and pastures in the summer, and follow the fattening sheep and ewe lambs on the roots in the winter. They have a run on the pastures once a week, and a fortnight before lambing are left there entirely, having a small quantity of roots and some hay given them. After lambing they get mangolds daily, and are better done until the lambs are weaned. The lambs are always shorn, and average 3 lbs. of wool each. The old sheep average $8\frac{1}{2}$ lbs. of wool per head.

Horses.—The working horses are of a useful stamp. They have 14 lbs. of corn and a little hay each through the winter every day, and in the summer depend upon green food with a couple of pounds of corn. The hacks and colts run in the yards during the winter and on the pastures in the summer. They deserve no especial comment, as is the case with the pigs.

Fences, Roads, and General Neatness.—The fences are of the prevailing character in Somersetshire, being placed on banks from 5 to 8 feet wide, and about the same height. They are double-planted, and consist of almost every variety of wood except blackthorn, and are a fertile source of weeds. The banks have been curtailed by the present tenant, and the sides were found neatly brushed; but on inquiry why the weeds and

brambles were left to grow upon the summit, it was ascertained that a new edict had just been issued by the agent of the estate, insisting that the occupier was not to make hedges till of four years' growth or more; not to cut them the last year of the term, nor make more than a fourth part of the hedges in any year; not to cut the tops of hedges except when made, and to give agent or bailiff five days' previous notice of making; to do the work efficiently, and before the 10th of March, and as much as may be when the land is in tillage. Such a clause, if insisted upon, determines an epoch for retrograde husbandry on at least this farm, and must be discouraging to an enterprising tenant. The gates are in good order, and the premises well and neatly kept.

Cottages and Labour.—Only two cottages are let with the farm. The other labour is drawn principally from the village of Capton.

Carters work with their teams, which contain three horses each, from 8 A.M. to 5 P.M., 1 hour being allowed for dinner. They receive 13*s.* per week, and 10*s.* bonus extra per quarter. In summer time they make from $1\frac{1}{4}$ to $1\frac{1}{2}$ day's work within the 24 hours, being paid in proportion to the amount of work done: thus, for example, in ploughing the last furrow for turnips, three horses working abreast accomplish with a double plough 3 acres a day. For this the carter receives $1\frac{1}{2}$ day's pay. A stockman who works early and late receives 16*s.* per week, and cottage and garden rent free. Shepherd, 15*s.* per week, cottage and garden rent free, and 3*l.* bonus for the lambing season. General workmen 13*s.* per week. Hours of labour 6 A.M. till 5 P.M., and $1\frac{1}{2}$ hour's interval for meals. Boys, 4*s.* per week. Women, 5*s.* per week. Payment by results is also encouraged in the shape of piece-work. Swedes are Dutch hoed and singled on this principle, and harvesting has been partly worked in the same way. The last few years the men have had a self-delivery reaping machine, with horses and driver, found, and also a man to sharpen knives and cut the corners of the grain, and have been paid 4*s.* 6*d.* per acre for cutting, binding, and stooking. The carrying has been done by day-work, the labourers receiving 3*s.* 6*d.* per day, and cider *ad libitum.* When the crops are lodged the scythe is used, and 3*s.* 6*d.* per acre given for cutting. No cider is allowed for ordinary work, but some is occasionally given at the employer's discretion. The cost of labour has steadily increased from 3*l.* 10*s.* per week, or something under 200*l.* per annum, in Mr. Bowerman's father's lifetime, to

290*l.* in 1872,
323*l.* in 1873,
432*l.* in 1874,

or from 16*s.* per acre in 1850 to 32*s.* 6*d.* in 1874. The alteration in the three years ending 1874 is very marked, the cost of labour being 22*s.* per acre in 1872, and 32*s.* 6*d.* per acre in 1874.

MANURES and FOOD PURCHASED.

Years.	Manures Purchased.		Total.
	Nitrate of Soda.	Bone Manure.	
	£	£	£
1872	45	115	160
1873	68	122	190
1874	54	96	150

Corn and Cake.

	£
1872	520
1873	612
1874	850

Permanent Improvements.

	£
Outlay on buildings	300
Drainage, &c., on land	200
	£500

The third inspection, on July 10th, proved the promises of the spring to be fully realised. The clovers and pastures were all that were expected. The hay harvest was just completed after a tedious time. The mangolds were making great progress. The swedes were mostly ready for hoeing, and the common turnips just put in. The grain crops were heavy, the wheat being slightly lodged in one or two places and tinged more or less with red-rust, but to no greater extent than was the case in most of the other wheat crops inspected in the county. The barley was very long in the straw and good in the head, but rather too much inclined to go down; and it is our opinion that such heavy dressings of nitrate of soda as were this year applied might with advantage be diminished if not altogether discontinued. The quantity of grain and meat produced from this farm by sustained good management reflects great credit on the tenant. The character of his live stock is also very superior, and the Judges had no hesitation in awarding Mr. Bowerman the second prize offered by the Society in Class III.

Other Farms in Class III.

The following well-managed farms were looked over a third time.

Mr. Culverwell's Farm.

	A.	R.	P.
Arable	152	0	4
Pasture	160	3	2
Total . .	312	3	6

This farm is $1\frac{3}{4}$ mile S.S.W. of the town of Bridgwater. The soil is a rich loam on the new red sandstone. The subsoil varies; gravel, clay, and marl being all found. The latter in some cases is somewhat intermixed with the surface-soil, and in such instances the land is of a heavier description. The climate is very genial. Wheat is generally shot in ear the first week in June.

The occupation is held under several owners. The principal portion is held on a twenty-one years' lease, ten of which are unexpired. The remainder is rented from year to year, commencing from Michaelmas Day.

There is an exceedingly good house, with nice pleasure and kitchen gardens.

The buildings have recently undergone thorough restoration, and with the additions made are good and serviceable. There is a fixed 6-horse-power engine, and machinery for threshing, pulping, grinding, and chaff cutting, sawing, and cider making.

Grass Land.—The pastures are chiefly situated at the lower end of the farm, but some of the fields are interspersed among the arable land. The sizes of the fields vary from 4 to 17 acres, and they are for the most part irregular in shape. The land is naturally very good, and will feed more than a full-grown bullock to the acre. The practice is to mow 40 acres every year, but meadows are not specially set aside for hay. The ground mown is usually top-dressed with a compost consisting of road-scrapings, manure, and soil. The pastures derive an abundant supply of water from a trout brook which runs through them.

Arable Land.—The arable land is managed on the four-field system, with slight modifications.

The course is carried out as follows:—

Roots,	Beans and Clover,
Wheat and Barley,	Wheat.

About a third of the wheat stubbles are sown with *trifolium incarnatum* and vetches, and the rest are prepared for cabbages, mangolds, and the earlier-sown swedes.

Ten acres of beans are seldom exceeded; and if the spring

wheat of previous growth is on a larger acreage than that, part of it is seeded down the same as the barley.

Roots.—Cabbages are drilled about the middle of March, on land cleaned in the autumn and winter-ploughed 7 to 8 inches deep; they are put 30 inches apart, and singled a distance of 2 feet. Mangolds are sown 20 inches apart on the flat, and swedes and common turnips 18 inches. Farmyard-manure is applied to the land where it is intended to remove the crop for the stock, and 4 cwt. of superphosphate and dissolved coprolites is used per acre for all the roots which are sown with Reeves' manure-drill with steerage. Vetches are put on those parts of the stubbles that are to be succeeded by common turnips. The Yellow Globe mangold, Improved Purple-top swede, and Aberdeen hybrid, and Green Round turnips are the varieties generally grown.

Wheat.—Thick-set Essex is usually sown. The seed is changed every two years. The ley ground is sown towards the end of October with 6 pecks per acre, and this quantity of seed is increased as the season advances and also where wheat succeeds roots. The leys are partly manured with farmyard-manure and partly with lime previous to being sown with wheat.

Barley.—Chevalier barley, at the rate of about 10 pecks per acre, is sown after swedes or turnips fed off. It is seeded down with mixed seeds in the following proportions—

5 lbs. of trefoil.
3 ,, alsike.
10 ,, broad clover.
½ bushel of Pacey's rye-grass.

ACREAGE UNDER RESPECTIVE CROPS THIS YEAR.

May, 1875.		July, 1875, or to follow Crop.
Acreage.	Crop.	Crop.
68	Wheat.	Wheat.
11	Barley, seeded.	Barley, seeded.
10	Beans.	Beans.
23	Clover.	Clover.
4	Cabbages.	Cabbages.
10	Fallow.	Swedes.
5	Ditto.	Tankards.
8	Mangolds.	Mangolds.
10	Vetches.	Aberdeen hybrids.
3	Trifolium.	Swedes.

SUMMARY.

Cereals	79 acres.
Beans and Clovers	33 ,,
Roots and Green Crops	40 ,,
Total . .	152 acres.

The seeds are depastured till the 1st of May, are then let up for mowing, and are afterwards again grazed until the leys are ploughed for wheat.

Our Christmas visit enabled us to see some very good swedes in the ground, and a fine piece of Aberdeen hybrid and Green Round turnips being consumed on the land by the sheep. The wheat stubbles were in good order, portions having been sown with vetches and trifolium, and the rest in course of preparation for the ensuing crops. Ten admirably well fed Devon oxen and cows, weighing from 12 to 15 score per quarter each, were in the stalls, and had that day been sold. The young stock were all on the pastures, receiving a daily allowance of turnips and straw. The lambs were on the turnips, doing well. The breeding flock of sheep were on the pastures, and close upon lambing. Several of the ewes had cast their lambs, and this indifferent commencement culminated in the loss of a good many ewes before the completion of the lambing season. Our second visit showed us the autumn and spring wheat not looking very well, and suffering from the prevalence of annual weeds; but on the occasion of the third inspection, we found the wheat crops had very greatly improved, and apparently were likely to prove productive. They were slightly affected with red-rust. The beans were very fine, the mangolds forward; swedes very straightly drilled had just been singled, and the turnips had been well put in. The stock were all thriving, with the exception of one lot of lambs.

The numbers of cattle, sheep, and horses of all ages on the farm were as follows:—

	In December.	In July.
Cattle	63	65
Sheep	429	518
Working Horses	8	9

Cattle.—Seven Devon dairy cows are kept, and a pure Devon bull. The cows drop their calves about Christmas, and the calves run with their mothers for 3 months, and are then taken on hand and well done till the following spring. The heifers keep up the dairy as the aged cows are fattened off, and the bullocks are made up to number 15 by purchase. The steers are sold fat at Christmas as 3-year-olds. The last 6 months they are well fed, commencing with 4 lbs. of cake on the grass, and finishing with 12 lbs., and an allowance of bean-meal. The young stock have no cake or corn on the grass.

Sheep.—The sheep are a good uniform flock of Dorset horns, the breeding ewes numbering 180. The system of treatment is much the same as that already described in the report of Mr. Hose-

good's flock, with the exception of the offspring relying more on the grass land of this farm. Those ewes that turn again after having been with the ram in August, are put to a long-woolled tup, and their lambs are sold off fat instead of coming out as yearlings off the roots. The off ewes are sold fat to the butcher in the summer, or early in the autumn. The lambs are shorn, and will average $2\frac{1}{2}$ to 3 lbs. of wool each, the stock ewes cutting from $5\frac{1}{2}$ to 6 lbs. per head.

Fences, &c.—The fences round the pastures are wild and rough; and those enclosing the arable fields are of the character already adverted to, growing on their high and wide banks, maple, sloe, elm, ash, and oak. There are no roads, with the exception of that approaching the house.

Manures and Food Purchased.—The quantity of linseed-cake and corn consumed amounts to the value of 400*l.* per annum. Superphosphate for roots costs 50*l.* a-year.

Cottages and Labour.—There are nine cottages attached to the farm, three of which are thatched. They contain two bedrooms each.

The labour-bill averages 25*s.* per acre, and has increased 5*s.* per acre within the last three years. The value of task-work has also rapidly risen.

Improvements.—The permanent improvements effected by the tenant on Durleigh Farm, in underground draining, subsoiling, levelling hedges, filling in marl pit, putting up wire fencing, and reclaiming bog, have exceeded a cost of 335*l.*

The farm is economically managed; the crops upon it are likely to be productive, and the stock is good.

Mr. Gadd Davis's Farm.

	A.	R.	P.
Arable	125	2	9
Pasture	86	0	17
Total	211	2	26

Situation, Soil, Climate and Geology.—This farm is within $6\frac{1}{2}$ miles of Taunton, in a westerly direction. It combines a mixture of several soils, being situated at the junction of the new red sandstone with the dolomitic conglomerate. The subsoil consists of clay and gravel, and the bottom meadow-land is an alluvial deposit on them. The land is not naturally rich, but it has a strength of character that will produce good results in return for superior mechanical cultivation. The climate is equal to any in this favoured county.

House and Buildings.—The house is a useful and commodious farm residence, and, with its garden, fronts the approach through the farm. The farm-buildings are behind it, and are a credit to both landlord and tenant. They are built of red sandstone, and the roofs are slated. There are double yards and open byres, as well as separate feeding-boxes for fattening cattle. The machinery has been arranged with considerable skill and forethought, and is worked by a water-wheel. The motive power for working the machinery is at a distance of 180 yards from it, and is connected by means of a long spindle extending that length. The loss from this long connection is estimated at 2-horse-power, the power being equivalent to 7-horse-power at the stream, while 5-horse-power only becomes available at the buildings. A fixed threshing-machine is used, and winnowing-machinery, chaff-cutter, pulper, and kibbling-stones are all conveniently erected with a view to the economy of space and labour. The finishing of the grain for market is done by separate winnowing, the power derived from the water-wheel being insufficient to complete all the processes at the same time.

Tenure.—The tenure is from year to year from Michaelmas Day, and the landlord agrees to take the tenant's fixtures, with water-wheel and machinery, at a valuation at the end of the term.

Grass Land.—The grass land is by no means of first-rate quality. A trout brook, which is a tributary of the Tone, skirts the bottom of it, and forms a boundary to the farm. By diversion, a copious stream of water passes also on the upper side of the meadows, and, after supplying the water-wheel, is then applied for irrigation purposes. The overflow of the yards is collected in a pond, and used in a similar manner. The under-drainage of the upper and arable portion of the farm can likewise be utilised for flushing the meadows, by diverting it from the main drain on its entrance into the upper portions of the pastures. Bickford's system of irrigation has been adopted, and has found favour with Mr. Davis. The effect of water action on this land is apparently beneficial, but not so markedly satisfactory as in those instances where springs are used nearer their origin, and where consequently the temperature of the water is higher.

The meadows have a cold white clay subsoil, with occasional beds of gravel. They have been drained from 6 to 7 feet deep at a distance of 200 feet apart, but from the rushes that still remain the space between each drain appears to be too great. The whole of the grass land has not yet been prepared for irrigation.

An experiment with top-dressing has been tried this year, with apparently good results in each instance, although, as the

grass had not been mown, a definite comparison could not be drawn.

One plot was top-dressed with 50*s*. worth of Proctor and Ryland's grass-manure. Another with 50*s*. worth of mixture recommended by Mr. Thompson in his essay on the 'Management of Grass Land;' and another with 1 cwt. of nitrate of soda, 2 cwt. of kainit, and 4 cwt. bone superphosphate.

The fields adjoining the bottom brook are usually kept for hay; but it is not an invariable custom to mow the same land annually. Top-dressing with soil and lime is to some extent resorted to, but irrigation is the principal resource relied upon for sustaining and improving the condition of the grass. A large outlay has been made by the tenant in levelling and otherwise preparing the meadows for irrigation.

Arable Land.—The arable land is, generally speaking, very heavy. It is cultivated much on a four-course system, but without adhering rigidly to the rotation. The rotation sometimes runs—

$$\text{Roots, Wheat,} \left\{ \begin{matrix} \text{Beans,} \\ \text{Seeds,} \end{matrix} \right\} \text{Wheat.}$$

Barley is not often sown, and does not seem to do well on this soil. This season, as in many other places, the drought of last summer had here caused a deviation from the usual mode of procedure. The young seeds having partly failed, a portion of the old leys had been left down, and barley sown after wheat. *Trifolium incarnatum* and vetches are sown on about a third of the stubbles, and followed with common turnips, put in about the middle of July.

Mangolds.—Yellow Globe are grown, and, as is also the case with the other roots, are sown on the flat. The drill is arranged to place the rows 22 inches and 18 inches apart alternately, the object being to facilitate hoeing with a triple-footed horse-hoe, the horse being made when performing that work to walk up the wide drill. 6 cwt. of bone superphosphate per acre is applied for all roots, and in addition farmyard-manure is ploughed-in for the mangold crop.

Wheat.—The White thick-set Essex variety of wheat is grown, and it is Mr. Davis's custom to top-dress it in the spring with 1 cwt. of nitrate of soda and 2 cwt. of salt per acre.

Acreage under respective crops this year:—

Wheat	50	acres.
Barley	10	,,
Beans	5	,,
First year's seeds . .	19	,,
Second year's seeds . .	26	,,

At our final inspection we found the growing wheat crops improved, although not heavy; they appeared to be suffering in a slighter degree from red-rust than on any of the other farms looked over. The barley was not good; but the beans, on the other hand, were strong and well-podded. The clovers were weak, especially those of the first year's growth. Mangolds were a disappointing crop, considering the trouble that had been bestowed upon them and the superior cultivation of the field they were on. Swedes were looking well, and the turnips were in the act of being sown on a good fallow after vetches and trifolium; the former fed off, and the latter partly fed and partly carted away for the horses. The vetches had been a very heavy crop, and the trifolium also was good. The live stock were all thriving.

Numbers and description of stock:—

Cattle	60
Sheep	267
Working Horses	8
Pigs	4

The cattle are of the Devon breed, and 17 dairy cows are kept. The young stock are reared, as before described, and the steers are brought out fat at three years old.

The sheep are Devon Long-wools. The wether lambs are fattened on the turnips and swedes, and are sold early in the spring, the off-ewes being sold when ready in the summer.

Fences, Roads, and General Neatness.—The fences dividing the pastures are constructed of iron, and are neat in their appearance. Those separating the plough-ground are the old Somersetshire boundaries so often before alluded to. Many of the old hedges have been removed by the tenant, and some alterations have been well devised and executed in the re-division of fields. The roads round the buildings have been made by the tenant, and every part of the premises is well cared for.

Manures and Food Purchased.—Manures purchased amount annually to about 25*l.* for nitrate of soda for top-dressing grain; and about 45*l.* for bone superphosphate for roots.

Food purchased costs about . .	£65	per annum.
Home-grown Corn consumed .	75	„
Total	£140	„

Cottages, Labour, and Permanent Improvements.—There is one cottage attached to the farm. The labour-bill last year came to about 1*l.* per acre; but the calculation for cider allowed is low. This shows an advance on the previous year of nearly 15

per cent., but no increase on former years. The water-power much economises labour; and a proportion of the subjoined expenditure on permanent improvements would perhaps in the ordinary way be placed in the general labour account, while in this case it is calculated separately.

Permanent improvements since 1865:—

Improvements to buildings, stackyards, bringing water-supply, and making roads, 408*l.* 18*s.* 5*d.*

Drainage of meadows (landlord finding pipes), laying out for irrigation on Bickford's system, making drinking-ponds, levelling banks and land, taking up hedges, and filling ditches, labour in laying down five-acre field to permanent pasture, 290*l.*

Outlay on machinery, 331*l.*

The latter item perhaps scarcely fairly comes within the category of permanent improvements.

Mr. Thomas Hembrow's Farm.

	A.	R.	P.
Arable	79	0	14
Pasture	123	3	8
Total	202	3	22

This farm is eight miles east of Taunton. It commences in the historic district of Athelney in the marshes, close to which station a monument is erected in commemoration of a victory over the Danes by Alfred the Great in that neighbourhood.

This marsh is part of Stanmore, and adjoins West Sedgmoor. It is watered by the River Tone, which, together with the Yeo and the Isle, forms a junction with the Perrot in the vicinity of Stanmore and Athelney Bridges, some short distance nearer the sea. The accumulation of water from the marshes is collected on either side by means of open cuts, and is pumped over into the river by a fixed steam-engine.

A rate of 10*s.* per acre is annually levied on landowners for original expenses connected with this system of drainage, and this sum is calculated to repay principal and interest in twenty years from the completion of the work.

The maintenance of open ditches is paid for by a *pro rata* levy on the occupiers, and the yearly outlay varies from 5*s.* to 10*s.* per acre. Landlord's and tenant's charges are paid for by Mr. Hembrow. The climate is to some extent affected by the moisture of the marshes, but is on the whole salubrious.

The soil is of two distinct descriptions:—

1st. The alluvial deposit of the marshland.

2nd. A strong loam of a retentive character upon the new red marl on the higher part of the farm above the marshy deposits.

The tenancy of the rented portion is a yearly occupation from Michaelmas to Michaelmas, but 50 acres of the occupation are the property of Mr. Hembrow. The house is a fine old ecclesiastic edifice, partially surrounded by an ancient moat. The thatched buildings are by no means commodious. The drainage from the yards runs into the moat, and is carried thence by means of a ditch to a meadow beyond.

Grass Land.—Most of the pastures are in the marshes, where the alluvial deposit is some 6 feet in depth. The water is not perfectly removed, otherwise this grass land would rank in the first order of pasturage. As it is, it will feed, and it carries, large quantities of stock of all descriptions in the summer months. It is never manured, and its capacity has not been found to decline from constant grazing and mowing. A goodly proportion of hay is secured from it from year to year, and it proves a useful auxiliary to the upper part of the farm in every way. The pasturage round the house is good, but quite different in its nature from the marshes. No rule exists as to always mowing the same fields.

Arable Land.—The arable land is chiefly confined to the higher parts of the farm. It is a strong red soil of a retentive character. The subsoil is clay with occasional veins of gravel. A seven-course rotation is adopted—

Roots,	Wheat,
Barley,	Beans,
Seeds,	Wheat.
Seeds,	

The clovers are sometimes left only one year, when a larger proportion of cereal and leguminous crops is taken.

The farmyard-manure is applied for wheat and beans, and the latter are planted 20 inches apart for horse-hoeing and thorough cleaning. Nothing but broad clover is sown for seeds, and they are always mown once, and not infrequently let up again and harvested for clover seed.

The acreage in roots is small, from 7 to 10 acres. It is divided into four sections. The stubbles are fallowed and left bare on two of them for mangolds and early swedes; one is devoted to the growth of a couple of acres of trifolium, and the other enables a small breadth of vetches to be secured. Common turnips follow trifolium and vetches, and are sown on the flat

20 inches apart. The whole of the green crops are carted off for the horses and stock at the buildings, and the roots also come to the premises for the support of the live stock in the winter.

Acreage in respective crops, July 1875:—

Wheat	30 acres.
Barley	14 ,,
Beans	18 ,,
Clover	12 ,,
Roots	7 ,,

At our last inspection we saw good fields of wheat slightly attacked by rust, and thick and finely podded crops of beans. Barley was not quite so satisfactory. Broad clover was a very great crop. Mangolds and swedes were doing well, and common turnips had been recently put in the ground. The land was clean and well cultivated; the stock were numerous, and on the whole looking well.

NUMBERS AND DESCRIPTION OF STOCK ON STOKE ST. GREGORY FARM.

December, 1874.		May 19th, 1875.	
Cattle	54	Cattle	88
Sheep	126	Sheep	119
Working Horses	7	Working Horses	7
Hacks and Colts	5	Hacks and Colts	6
		One Sow (and Pigs)	1

The dairy consists of eight cows. They are roomy Somersetshire Devons with a good deal of quality. A compact and useful Devon bull is also kept. The calves are weaned at 9 days old, and hand-reared for 4 months, after which they take their chance on the pastures. After the calves are taken off them, the cows are used for dairying, butter and half-fat cheese being made. Most of Mr. Hembrow's stock is bought in, the rear being quite insufficient for the capabilities of the farm. The young stock are kept in the winter on hay and a few roots, and in the summer are grazed on the marshes, and ultimately fatted off them at 3-years-old. Older beasts are bought-in in the spring and fed off the marshes. This will account for the difference in the number of cattle on the farm in December and May.

Sheep are bought-in as lambs in August, winter-kept, and sold the following September fat off the marshes. Occasionally a purchase of yearlings may be made in the spring for summer feeding. Part of Mr. Hembrow's sheep were Dorset Horns, and the remainder Devon Long-wools.

The working horses were very useful, and the colts seemed likely to prove valuable.

The fences were made the most of, and better managed than on many of the farms seen. They were, however, of the Somersetshire type. Hedgerow timber prevailed very much, and rendered it more difficult to keep the hedges in good order. The premises and stackyard were very neatly kept.

No outlay is made in artificial manures, and next to none on foods purchased. The marshes are supposed to do everything.

There is one cottage attached to the farm. Labour is abundant in the district, and the rate of wages is from 12*s.* to 15*s.* per week.

Some of the land has been drained, but a good deal remains to be done. That accomplished was done at the tenant's expense, the landlord finding the pipes.

The farm is economically and well managed, and is a fair specimen of a self-supporting farm that does not deteriorate, partly owing to good cultivation, partly to inexhaustible grass land.

Mr. J. R. Keene's Farm.

Arable	81	acres.	
Pasture	166	,,	
Hill pasture . . .	78	,,	5 miles distant.
Total . . .	325	,,	

Situation, &c.—This farm lies about 7 miles north of Wells. It rests upon a table-land which forms a sort of lower range of the Mendip Hills, and is at an altitude of 450 feet above the level of the sea. The soil is kindly and friable, on the junction of the Limestone shale and the Lower Lias shale. The rock lies immediately under it at a depth varying from 4 to 6 inches. The climate is severe and backward, and the rainfall excessive. The seasons are a fortnight later than those of the Bridgwater and Taunton levels.

The tenure is a 21 years' lease, and the covenants are fair, an allowance being made for artificial manures and feeding-stuffs used the last year of the tenancy. This is the only case that came under our notice in Somersetshire in which the principle of tenant-right was acknowledged.

The house and buildings are good. Chaff-cutting, pulping, and corn-grinding machinery are suitably arranged, and are

worked by a portable engine. This engine is also used for threshing, Mr. Keene possessing a moveable threshing-machine. A large lambing barton at the back of the old buildings has recently been erected by the tenant, with the stipulation that he shall be allowed its value at the expiration of the tenancy. Considerable outlay has also been made on the older parts of the building at the occupier's expense. The drainage of the farmyards escapes into an adjoining pasture field and is there distributed.

Grass Land.—Seventy-eight acres of grass lies a distance of 5 miles away on the summit of the Mendip Hills. It is essentially hill pasture, and is only available as a sheep-run in the summer months. The pastures on the home farm bear a good face and graze well. They are better than the appearance of the soil would at first sight indicate. Ten acres are dressed yearly with a mixture of manure and soil, or lime and compost The land is mown and grazed alternately, and 50 acres are usually kept for hay. Watering-places and drinking-ponds have been arranged with considerable skill in the various pastures and have been a heavy source of expenditure to the occupier.

Arable Land.—No restrictions on cropping are exacted. The system usually adopted is—

Roots,	Seeds mown (and generally broken up for mustard, rape, or common turnips),
Barley seeded,	Wheat or Oats.
Seeds grazed,	

Wheat loses plant if sown after the first year's seeds, an under ordinary circumstances does not thrive, the district bein too high and the climate too cold and wet.

Barley is not sown until the end of March or beginning c April. Ten pecks of seed are allowed to the acre.

Clovers.—The young grasses are sown at the rate of 12 lbs. c clover, 8 lbs. of trefoil, and ½ a bushel of Scotch rye-grass; or fo two years' ley, 2 lbs. of white Dutch, 2 lbs. of plantain, 5 lbs. c alsike, 3 lbs. broad clover, and 1 bushel of Pacey's rye-grass.

Oats.—The district suits oats better than any other cerea Black tartarians are grown. The crop is sown about the middl of March, and generally proves very productive. As much a 14 pecks of seed is sown to the acre.

Roots.—Farmyard-manure is ploughed-in for both mangold and swedes.

Mangolds (the Yellow Globe variety) are sown in April; 6 cw of salt and 3 cwt. of Proctor and Ryland's manure are applie per acre. They are sown on the flat 19 inches apart, and hor and hand-hoed after coming up.

Swedes are sown the beginning of July, and common turnips after vetches on about a third of the root-course.

The roots are sown with the liquid-manure drill, and 3 cwt. of superphosphate per acre. The vetches are chiefly fed on the land by the ewes and lambs, but a small proportion is removed for the working horses.

ACREAGE UNDER RESPECTIVE CROPS.

May, 1875.			July, or to follow.		
23	acres	of barley.	23	acres	barley.
17	,,	of oats.	17	,,	oats.
9	,,	2 years' clover-ley (mown).	9	,,	rape, common turnips, and mustard.
7	,,	1 year's seeds (mown).	7	,,	seeds.
13	,,	fallow (after oats).	13	,,	swedes.
$4\frac{1}{2}$	,,	mangolds.	$4\frac{1}{4}$	,,	mangolds.
5	,,	vetches.	5	,,	swedes, common turnips.

Our ultimate inspection showed us some very good crops of oats, some fair crops and one strong piece of barley, and good seeds. Mangolds had suffered a check, but were recovering, and swedes were hoed out and doing pretty well. The vetches had been very good, and swedes and common turnips were coming up on the ground from which the intermediate green crops had been fed off. The cattle stock looked well, but the lambs seemed to have been rather pinched.

Quantities and description of stock—

Cattle	64
Sheep	634
Working Horses	4
Colts and Hacks	4
Pigs	48

One of the most interesting features on this farm is the dairy of 36 milky-looking well-bred Somersetshire Shorthorn cows. They are timed to calve in February or March, and all but 13 of the calves are disposed of a few days after birth at 25*s*. each. Those selected for rearing are 10 heifers and 3 steers; they are kept on skim-milk and linseed for 10 weeks, and then get an allowance of 1 lb. of linseed-cake and meal mixed per day each, with a little hay, and are turned out to grass. The heifers are bulled at 15 months old, and the bullocks are sold at $2\frac{1}{2}$ years old off the grass as good stores. The draft cows are realised in October or November. They are dried in August, when the young heifers are coming into the dairy, and are therefore in good condition for the graziers of the lower districts. My

colleague, Mr. Little, speaks highly of the internal arrangements and management of the dairy. The dairy cows are not allowed to run on the same ground as the sheep.

A yearling pedigree Shorthorn bull is now being used.

The flock of ewes is cross-bred. A Hampshire ram is first used for 2 years, and a change is then made for an Oxford Down or a Cotswold for a similar length of time. The lambs run before their mothers on the vetches while they last, and then recourse is had to the seeds, pastures, and mustard and rape till the earlier turnips are ready. They consume half these and half the swedes on the land, the wethers running first and the stock ewes bringing up the rear. The wethers are allowed ½ a lb. of mixed corn, and linseed and cotton-cake, from the period of going on the roots until the following shearing time, when artificial food is discontinued. They are sold for grazing on the marshes in July, and are brought out very quickly from the lower pastures.

The stock ewes and the chilvers retained for stock are sent to the hill pastures after the lambs are weaned. The off ewes are sold in August or September for stock purposes. The ewe or chilver lambs that are intended to recruit the flock are wintered off the farm in accordance with an old custom of the district. They are sent away from October 12th, and remain on the farm to which they are consigned until the 6th of April following. Shearing commences June 1st. The tegs clip about 7 lbs. each and the stock ewes 5 lbs., making an average of 6 lbs. per sheep on the whole flock.

Pigs.—Three white Somersetshire sows are kept. They are crossed with a black Berkshire boar, and the numbers fed are made up by purchase.

Fences, &c.—The fences are for the most part stone walls built of loose stone. The larger part of them are about 4 feet 6 inches high and 18 inches wide. A few are double walled, enclosing a bank of soil, upon which a few thorns and trees are grown for shelter. The base of these is a couple of feet wider than their top, say 6 feet to 4, and the earth forming the bank having been taken from either side of it, the fence forms both a good shelter and boundary. The stone walls present a neat but rather bleak appearance. Those adjoining the entrance to the house and along the main road are built solidly with mortar. A few quick hedges have been planted, and are growing well.

Artificial Manures.—Bone superphosphate for roots averages 25*l.* per annum.

Food Purchased.—Linseed- and cotton-cake, corn, and meal average 147*l.* per annum.

Home-grown Food consumed.—Oats, barley, peas, and tail wheat average 125*l.* 10*s.* per annum.

Cottages and Labour.—There are no cottages connected with the farm, and the nearest residence is $1\frac{1}{2}$ mile distant.

The milking is done by men, and the labour-bill of the farm amounts to nearly 1*l.* per acre. Labour has increased about 10 per cent. in 5 years.

Permanent Improvements.—The average outlay per annum on permanent improvements the last 5 years has been 62*l.* per annum, irrespective of the calculated labour payments.

Mr. Keene's farm is almost exclusively devoted to the breeding and rearing of stock, and the production of cheese and other dairy produce. Nothing is sold fat, except the cheese. Looked at in all its aspects, this farm is unique among the competing holdings.

Mr. James Mead's Farm.

Arable land, 192; pasture, 33: total, 225.

Situation, Soil, and Geology.—Mr. Mead's farm is an example of another distinct type of agriculture in Somersetshire. Situated 8 miles east of Taunton, the greater proportion of the land is of a heavy nature on the Lower Lias shale. The Lias rock lies from 2 to 4 feet beneath the surface, and the whole district surrounding Curry Mallet is quarried for this stone, either for building purposes or for making lime. At two miles' distance, in the neighbourhood of West Sedgmoor, about 50 acres are held. This is chiefly plough land, and is barely safe from flooding, indeed it is sometimes under water. Its nature is peculiar, being something between alluvial deposit and peat, and, as was remarked by my colleague, Mr. Outhwaite, it is that sort of land that takes a winter to get well saturated, and a summer to become thoroughly dry again.

The climate is early.

Tenure.—The tenure varies. Part is taken on a yearly tenancy, and part is held under Mr. Mead's brother, who, in his turn, is the last participator under a three-life lease, granted to his grandfather by the Duchy of Cornwall.

Houses and Buildings.—The house, which is slightly superior to a cottage, is in the village of Curry Mallet, and some inferior buildings are attached to it.

Irrespective of the Sedgmoor holding, the farm is very much scattered, and the fields are detached. A drive of about 2 miles was required to see the different fields on the home-farm, and one of an area of 2 acres connected with it, which was not visited, lies, we believe, a distance of 10 miles from the homestead.

Grass Land.—The grass land is only 30 acres in extent, and is grazed by cattle purchased in the spring.

Arable.—The land is of a heavy character. Mr. Mead is not particular respecting rotation of cropping. The course is sometimes

Beans,	Wheat,
Wheat,	Barley,
Roots,	Seeds;
Beans,	

or,

Wheat,	Wheat,
Roots,	Barley,
Beans,	Seeds.

The farm is not adapted for roots. It is essentially wheat and bean land, and the continued successful return in these crops on this farm is something remarkable.

The system pursued year by year is to cultivate the land deeply and well, and to manure it with a heavy dressing of lime before taking a crop of wheat, or beans, or barley.

The lime is manufactured on the farm; and the limestone being directly under the soil, no cheaper method of manuring could be adopted. The expense of its cartage to the Sedgmoor land is not of very great moment, and the effect of its application is very marked.

The wheat and bean crops are sown 8 inches wide, and have to be hand-hoed twice in the spring, otherwise chickweed (which grows very rapidly), groundsel, and other noxious plants, would overpower or materially injure them. The wheat is top-dressed in the spring with 5 cwt. of concentrated manure to the acre. Roots, which form a small proportion of the rotation, are consumed by the purchase of a few cattle in the winter, and these tread down a portion of the superabundant straw grown. The clovers are mown and fed by purchased sheep.

Acreage in respective crops, July 1875:—

Wheat	65 acres.
Barley	35 ,,
Oats	13 ,,
Beans	50 ,,
Clovers	12 ,,
Roots	17 ,,

When last seen, the wheat crops were exceedingly heavy, but suffering much from red-rust. The beans were also unusually good, and well podded. The barley was good, and the roots were up, but not very forward or regular. Fourteen Devon bullocks had been purchased after Christmas, and were being fed off the pastures with 4 lbs. of linseed-cake each per day. Two hundred wethers

had also been bought, and fatted on the seeds. The farmyard-manure made was small in quantity, and of an inferior quality. The excess of straw was being sold off at remunerative prices. There were 7 working horses on the land.

Fences are square-topped. They were closely brushed and kept free from weeds.

Manures and food purchased form an inconsiderable item in the year's expenditure.

Labour is drawn from the district of Curry Mallet, and amounts to about 300*l.* per annum.

This farm affords food for reflection; and, perhaps, had he been here inspecting, the scientific reporter recommended in some quarters as being essential to the embodiment of a farm report of any value, might have elucidated some hidden mystery useful to the agriculturist. Be this as it may, notwithstanding the old proverb that "Lime makes the fathers rich men and the sons poor," the fact stands out pre-eminently that its continued use for many years on this land has not produced exhaustion, notwithstanding the heaviness of the crops grown, the sale of a portion of the straw, and the return of little or nothing to the land in the shape of manure, with the exception of top-dressing for wheat and the lime used. How long this will last remains to be proved; and I can only attribute the continued successful growth of crops to a condition of soil, in which the elements of fertility exist to a large extent, but lie dormant, or in inaccessible forms of combination, until rendered available by the superior cultivation Mr. Mead practises, assisted, probably, by the stimulating and mechanical action of lime, and with the contingent advantage of a genial climate.

Conclusion.

I have particularised somewhat fully the methods of management adopted on the prize farms, because sound principles being first acknowledged, it is attention to minutiæ that in a large measure insures success in agricultural matters. At the risk, therefore, of being tedious, the detailed descriptions will, I trust, be more serviceable to the younger readers of the 'Journal' than if curtailed to a simple statement of results. In the case of the Hill Farm, the system of primary reclamation and the subsequent course of cropping were novel to myself, and may be of some interest to others.

A few observations may be called for from the facts already described. Comparisons are proverbially odious; and a great authority once stated that "nothing was so fallacious as facts,

except figures;" still I have ventured to compile the following Table with a view of showing the existing differences, and, to some extent, the stock-bearing power of each farm reported upon.

QUANTITY and DESCRIPTION of STOCK to every 100 Acres of Land under Cultivation in the County of Somerset, 1873, in England, 1874, and on the undermentioned Farms, July, 1875.

Names of Competitors.	Number of Acres of Pasture and Arable Land to every 100 Acres under Cultivation.	Horses used solely for Agriculture.	Mares and Unbroken Colts.	Cattle.	Sheep.	Pigs.	Total of Unbroken Horses, Cattle and Sheep equivalent to Cattle.*
The whole of England, 1874	Pasture, 43·4; Arable, 56·5	3·2 estimated	1	17·9	82·7	8·5	35·4
The County of Somerset, 1873	Pasture, 63·8; Arable, 36·1	2·1	1	25·2	86·8	11·7	43·5
DAIRY FARMS.							
George Gibbons	Pasture, 78·3; Arable, 21·7	3	..	25·2	50·5	60·6	35·3
Alfred R. Day	Pasture, 86·6; Arable, 13·3	2·7	..	38·8	..	77·7	54·3
FARMS IN CLASS 3.							
Obed Hosegood	Pasture, 60·2; Arable, 39·8	2·2	..	24·3	226·	..	69·5
A. Bowerman	Pasture, 31·3; Arable, 68·6	3·3	3	20·	108·3	4·1	44·6
W. T. Culverwell	Pasture, 51·2; Arable, 48·7	2·5	..	20·8	166·	..	54·
J. Gadd Davis	Pasture, 40·7; Arable, 59·2	2·8	1 nearly	28·4	120·9	..	53·5
Thomas Hembrow	Pasture, 60·8; Arable, 39·1	3·4	3·5	43·5	58·9	..	58·7
J. R. Keene	Pasture, 75·3; Arable, 24·6	1·3	1·2	20·3	195·6	14·8	60·6
James Mead	Pasture, 14·6; Arable, 85·3	3·1	..	6·2	88·8	..	23·9

* This column is computed: one unbroken colt being calculated as an average horned animal, and 5 sheep to the same equivalent.

Looked at superficially, these data would be apt to lead to erroneous conclusions, but read between the lines they admit of different deductions.

The true meat-producing capacity cannot be accurately measured by the value of the figures in the tabulated schedule.

First, because in some instances, as in the case of Mr. Hembrow's farm, the stock at the time taken is at the maximum, the practice being to buy largely in the spring, and fatten and sell off considerably before the winter.

Again, where a breeding stock is kept, the offspring of which is sold in a store condition, as is the system pursued by Mr. Keene on his occupation, the returns show an undue preponderance in favour of the holding. On the other hand, herds and flocks bred

and fed off create a continual strain on the farm, and relatively form a much greater burden, head for head, than under the circumstances before referred to. The solution of the question of the exact power of production of each farm under existing circumstances would be extremely complex, and the conclusions arrived at highly problematical; nevertheless, the stock-bearing capacity evinced by these Somersetshire farms, notwithstanding the anomalies referred to in the bases of computation, seems to determine itself very much according to the acreage of the arable land as compared to pasture. In most instances the numbers of stock returned increase in proportion as the pasture-land exceeds the tillage. This, I repeat, may be accounted for partly by the incidental circumstances alluded to, a fact that bears out in some respects the truth of the aphorism quoted; it may likewise be attributable, in some degree, to the well-known fertility of the grass land of the county, and it will probably, in no small measure, be found to arise from the excellence of the arable culture where the returns are highest.

Viewed from every aspect, the returns of these farms appear satisfactory by comparison, and are creditable to the occupiers.

Whether the increase of arable culture is in time to come to be the medium of a large augmentation of meat production or not I cannot venture to prognosticate; but the fact of the large percentage of additional outlay per acre in the labour-bills of the various farms already referred to, typical, no doubt, of identical results in other directions, coupled with other difficulties in obtaining satisfactory profits from arable culture, have been instrumental in causing a considerable area of land to be laid down to permanent pasture throughout the county of Somerset in the course of the last few years. This, in a county where roots are so readily raised, and intermediate crops so satisfactorily grown, seems the more surprising, except from the fact that increased production involves a larger outlay. But this outlay should be profitable, and the supposition that it is not may, possibly, be premature; it therefore seems to me not altogether improbable that the present state of things has been brought about quite as much from the somewhat strained relations that have of late existed between employers and employed as through the increased wages of the labouring population.

One or two more points call for a remark.

The existing customs are extremely variable and incommodious. Possibly suited to the times they were arranged for, they are now altogether out of unison with the spirit of the age. The fact of an incoming tenant having a right of pre-entry upwards of six months prior to the completion of the outgoer's term, and the latter having the power to remain in part-occupation of

the holding six months afterwards, cannot work harmoniously, and must be, I imagine, fast falling into disuse. It is to be hoped that the careful consideration lately accorded to the relations of all connected with the land will enable more workable customs to be introduced; and at the same time will found—for, in its nearly total absence, I can scarcely apply the term extend —a system of tenant-right suitable to the different districts of the county.

The use of improved implements was observable on most of the farms inspected; and that of reaping and mowing-machines is gradually extending, being accelerated considerably by the augmented value of labour. Steam-cultivation appears not to have made much progress, and I should imagine will not do so until the accessories to its profitable use are more developed. Take it altogether, Somerset is not a county to be thoroughly worked by this means. We only saw one set of steam tackle during our tour, and heard of no others being used; but we are glad to find that Mr. Robert Neville intends starting a set of double engines in the neighbourhood of Butleigh.

The custom of underletting the dairy seems wrong in principle. By its adoption a second middle-man is introduced between the landowner and the consumer, and, theoretically, either one of the lessors or the public must suffer. Taking a converse view, the principle is precisely the same as that involved in letting land at all, and if found to answer in the one case, may be worked advantageously in the other. It may fairly be argued, and it does not take much practical knowledge to be aware that such is the fact, that undivided attention, and the direction of individual exertion on its own account to any particular branch of industry, will produce more tangible results than can be obtained through the intermission of agency; and hence, let the principle be what it may, practice satisfies us that the system is not altogether unsound. On mixed farms a variety of work must be superintended and attended to by the occupier; and dairying, requiring as it does a great deal of direct supervision, if not actual co-operation, is apt to become less remunerative in the hands of a general good farmer than in those of a person who makes it his special business. Of course there is much to be said on both sides; but until the principle of direct supply is more clearly developed and more ably administered, it is difficult wholly to condemn this system.

One word respecting book-keeping. Most of those visited had an intelligent idea of their affairs, and could show clearly their returns on the various descriptions of crops and stock. In several instances 'Warren's Farmers' Account-book' was used, in which subdivisions of the principal items of the farm are

provided for. In others these subdivisions were made in accordance with the views of the occupiers. Stock and granary books were, as a rule, also kept. Beyond this, in the present position of Agriculture, it is difficult for the farmer to go; a true system showing the exact return on every item of farm production requires an amount of calculation and trouble utterly incommensurate with the total proceeds of a farm.

Nothing more remains to be added, except our acknowledgment of the courtesy we received from each and all of the competitors during the different inspections. Whatever changes may be going on around them, the unostentatious and genial manners that English farmers are generally accredited with have been fully developed, and remain still unimpaired, in the favoured county of Somerset.

J. Bowen Jones.
E. Little.
T. P. Outhwaite.

XXI.—*Report on the Exhibition of Live-Stock at Taunton.* By C. B. Pitman.

That the Society's visit to Taunton would be a financial success had never been anticipated; but its pecuniary loss would doubtless have been fifty per cent. less than it actually was if the weather had remained as fine on Wednesday and the two following days as it had been on the Monday and Tuesday. The torrents of rain which fell during Tuesday night and continued over the following day until Thursday morning, reduced the yard to a most pitiable condition; and it argues much for the pluck of the West Country people that the attendance was not even smaller than the turnstiles showed it to have been. This *contretemps* —it is bad to borrow from the French, but here we have a word most aptly designating the thing—was all the more to be regretted as the yard was beginning to fill very well, for on the Tuesday there were nearly 2000 visitors more than on the corresponding day at Bedford. Moreover, all who were present at Taunton will admit that the Society could not have had a better site for the Show; and it was generally agreed that the yard was the "prettiest," excepting, perhaps, that at Canterbury, in which an exhibition had ever been held. The beauty of the vale of Taunton Dene is proverbial, and the town of Taunton is situated in the most beautiful part of it, while in this part of Somersetshire, at least, agriculturists have not been backward in learning the lessons which it is the Society's business to teach. Much of the grass land near Taunton lets for 5*l.* or 6*l.* an acre, and it was upon some of this land that the exhibition

took place. The soil is a good deep loam; and this was so far an advantage, that the water drained away with comparative rapidity, whereas, if it had been good old West-Country clay the yard would have been little better than a bog by Wednesday afternoon. The efforts made by the Taunton people to give the Society a befitting welcome never relaxed, though the Local Committee had many difficulties to encounter. When the Show opened, at 9 o'clock on Monday morning, the yard presented a most attractive spectacle, and one of the sights which most struck the great majority of visitors was the handy way in which the various departments were arranged. The implement-sheds, running both right and left of the central avenue, stood nearest to the main entrance, the cattle were beyond them to the left, and the sheep and pigs opposite the cattle, to the right of the central avenue. Further still was the large horse-ring, behind which, and quite removed from the noise and bustle of the crowd, were the horse-boxes. These were roomy, lofty, and well-ventilated, and seemed to be the model of what boxes provided for the temporary accommodation of horses at our Shows should be.

The duties of President, during the Society's visit to Somersetshire, fell, as it was only most fitting that they should fall, upon Lord Bridport, who has done so much for the agriculture of the county to which he belongs, and one of whose last acts during his year of office was to enlist, as a Governor of the Society, His Royal Highness Prince Christian. Lord Bridport was able to announce, at the General Meeting of Members held in the yard, that the number of Members had increased very considerably since he became President; and I would fain hope that the visit of the Society to Taunton, disastrous as are the recollections of the three concluding days, may be instrumental in raising the total to something near the 10,000 at which Lord Bridport wishes to see it stand.

It would be too much to say that the live-stock exhibited at Taunton came up to the very high standard of excellence which has been reached at some previous Shows; but the cattle and the sheep were by no means a bad lot, though there was a marked falling off in numbers as compared with Bedford, Hull, Cardiff, and other recent exhibitions. There was a not less considerable decline in the number of horses and pigs; and while the total entries of live-stock at Bedford were 1527, only 1096 head were entered at Taunton.

	Horses.	Cattle.	Sheep.	Pigs.
Bedford (1874) ..	412	403	486	226
Taunton (1875) ..	235	340	359	162

That there should have been a great falling off in horses was not surprising, for Somersetshire and the south-western counties are not and never have been famous for their horse-breeding; but it might have been expected that the Devons and the Herefords would muster in great force, and that the Somerset and Dorset Horns, the Dartmoors and the Exmoors would have helped to make the show of sheep a particularly large one. It would seem, however, that, with the altered conditions of travel, we must no longer expect to see local breeds of cattle, sheep, or pigs showing the boldest front in their own districts, and it would probably be no exaggeration to say that as good Devons are bred in the Midlands as west of Bristol, though it did happen that at Taunton nearly all the prizes in the Devon classes were won by West Countrymen. We no longer look to Sussex alone, or even chiefly, for the flower of the Southdowns, and not one of the four first prizes for Berkshire pigs offered at Taunton went into the county from which this breed takes its name. With horses the case is very different. Whether because the owner of a horse which has anything approaching to good looks about it likes to enter it at the Society's Show, or from some other reason, there is always a strong proportion of horses belonging to residents in the district; and it follows, therefore, that when the Show is held in a great horse-breeding district, such as that within which Bedford is situated, there is invariably a strong muster of horses. The contrary is the case when the Society comes into the West, where there are probably fewer horses, certainly fewer good horses, than in any other part of the kingdom. At Taunton, scarcely a fifth of the 235 horses entered were the property of persons residing in Somersetshire; or, as I may say, taking here and giving there, less than fifty of the whole number exhibited were bred in the county. And even they failed to take their due proportion of prizes, for they carried off but ten out of the eighty-seven offered for competition: four firsts, four seconds, and two thirds. Moreover, the expense of transit from more distant parts of the country in which horse-breeding occupies a considerable place in the agriculture of the district must have served to keep the numbers down, for the railway companies do not make any reduction of their ordinary fares to the Show, and but little for the return journey.

Horses.

It would scarcely be too much to say that in Somersetshire the thoroughbred is almost as unknown as the Dodo; and this being the case, it is not surprising to find that the breed of

horses is generally bad throughout the county. Say what we will against the modern system of racing, there can be no denying the fact that a few good thoroughbred stallions in a district do much towards leavening the whole lump; and for this reason, if for no other, it is to be hoped that some of the landowners in the county of Somerset will enable their tenants to share in the benefits of Lord Calthorpe's fund. For obvious reasons, the Society, itself engaged in the task of endeavouring to improve our breed of horses, was unable to become a subscriber to this fund, which, from its very nature, appeals to private enterprise. Nor is it very much to expect that a hundred gentlemen should be found willing to pay the sum of 100*l.* for five years, in order that an experiment, which, if it succeeds, must confer lasting benefit on the agricultural community, should have a fair trial. There is no lack of money in the county; and the largest landowners, many of whom were present at Taunton, were enabled to see for themselves how poor a figure their county made in one of the smallest and most indifferent shows of horses which the Society has had for many years. Some five-and-twenty years ago races were held at Taunton, upon ground not very far from that on which the Show took place, but they, together with several other race-meetings in the county, died out for want of support—one sign, amongst many, that the breeding of horses was but little cultivated. The limited number of local entries helped to make the show of horses smaller even than it would otherwise have been, but the difference between the Bedford total of 412 and the 235 entries at Taunton was too great to be accounted for altogether in this way. Perhaps many of the exhibitors who never miss an important Show, and who exhibit more with a view to sale than anything else, may have fancied that their horses would not be properly appreciated at Taunton, or, if appreciated, not bought at the price which they might fetch in or near the metropolis. They were wise in their generation, no doubt, for the Somersetshire people do not seem to have become alive to the vast increase which there has been of late years in the value of horse-flesh, and the necessity of paying a very long price if you wish to get a good animal. Still, it is quite possible that exhibitors do not take sufficiently into account the readiness of foreign buyers to give large prices for horses adapted to their wants; and, as some large transactions are reported to have taken place at Taunton, in which foreigners figured as purchasers, many exhibitors will regret that they did not send something into Somersetshire.

The agricultural horses used in Somersetshire are perhaps as bad as are to be found in any other part of England; and the few specimens sent to Taunton, principally from the

neighbourhood of Bridgwater, did very little to redeem their character. They certainly had to compete against some very good horses adapted to farm-work; for though, as I have said, the entries were small, they were not in themselves below the average standard of excellence. Most of them were "on the big side;" and this in itself would have been deemed an additional reason for not competing by Somersetshire breeders, whose agricultural horses are too small to stand much chance with the larger-framed animals hailing from Yorkshire, Lancashire, and the Midlands. There were many such in the first two classes for agricultural stallions not qualified to compete as Clydesdale or Suffolk. The 2-year-olds were not so good as the older ones, of which only six entries out of the eleven were brought out for judgment. Lord Ellesmere's "Prince of the Isles," looking altogether out of condition, had to give way to animals in other respects his inferiors; and Mr. Tanner might not have won the first prize with his "Samson"—not to be confused with another "Samson," five years his senior, which won the third prize for Mr. Cooke of Tiverton—if Mr. Statter's chestnut "Champion" had come well out of a veterinary examination. There were but three young Clydesdale stallions, and the Judges did not deem the third good enough to receive a prize; but the older Clydesdales pleased them so much, that they commended the whole class, the six entries in which were remarkable for their combination of size and quality, but, above all, for their grand action. Why of the seven Suffolk 2-year-old stallions only a couple were shown I was not able to discover. The two animals present both belonged to Colonel Wilson, and the Judges were not long in awarding the red ribbon to "Prince Imperial," who came to Taunton fresh from his Brentwood and Bury St. Edmund's triumphs. He is certainly a grand specimen of the Suffolk carthorse, if, indeed, "carthorse" is the right word to use in connection with an animal that has all the style and quality of the choicest thoroughbred that ever stepped into a ring. The older Suffolk stallions numbered but four; and they were not a very taking quartett, though "Statesman" has plenty of bone to redeem his somewhat coarse appearance and defective quarters.

With twenty entries in the class for agricultural mares, exclusive of Clydesdales and Suffolks, it may be said that there was not much reason to complain; but nearly half of them were shown without foals by their sides, though these are, as a matter of course, set down as being in foal. In the conditions relating to the classes for breeding animals, it is prescribed that no mare shall be eligible for a prize unless certified to have had a foal in the year of the Show; or, in the event of a mare being

exhibited without a foal at foot, a certificate shall be produced at the time of entry of her having been served, and the prize withheld till a certificate be produced of her having foaled. But, even with these restrictions, it is almost a pity that all the prizes, and two out of the three commendations, should have been given to mares without foals. It would be as well in all cases where a brood mare is exhibited without a foal, to compel the owner to show whether she had a foal the year before, and to state how many times she had been barren since she had been at the stud. There were only four Clydesdale mares; and though the Judges withheld the third prize, these mares were a good level lot, very much better than the two Suffolk mares shown in the next class. The seven 2-year-old agricultural fillies were very much liked; the bay filly belonging to Lord Ellesmere, and Mr. Barber's "Flora," being good now, and promising to be better hereafter. The 3-year-old agricultural fillies were not an easy lot to judge, for the best of them—and there were four or five very nice fillies—had some trifling defect or other. A very grand mare was "Lioness," and she would have been placed first without delay but for a suspicious hock. It turned out, on further examination and inquiry, that she had struck herself coming into the yard; and the Judges, satisfied that there was nothing organically wrong, put her before Lord Ellesmere's "Duchess," who was first at Croydon, where Lord Ellesmere bought her, and who won three times last year. Altogether the agricultural horses were very good at Taunton.

The following is the Report of two of the Judges of Agricultural Horses, with some additional remarks by the third:—

In submitting the following report of agricultural horses at the Taunton Meeting, we may congratulate the Society on some of the classes being well filled, although in some cases the best animals were prevented from taking the prizes by the fiat of the veterinary inspector.

Class 1—*Agricultural Stallions foaled in* 1873—contained 14 entries. We had no difficulty in selecting No. 5, a clean, active, lengthy roan, with good back and loins, and flat-boned legs, but rather short of hair. The remainder of the class were a middling lot; the next winners having little contracted feet, and bad weak fore-legs.

Class 2. *Agricultural Stallions.*—We thought these a splendid lot on entering the ring, but upon close inspection, after weeding the five best out, we were obliged to ask the veterinary to make a general inspection, and his report being very unfavourable, we selected No. 15 for first—a bay, 4 years old, with a good back and great depth of chest, but short in his hind ribs; fine flat-boned legs, and a grand mover. He went tender in his fore-feet, but we heard the next day that it was from the effects of tight shoeing. No. 20 we placed second, the same honours that he has taken at the last four Royal Meetings. He is a horse of great depth, and takes the eye on first look; but he does not improve on inspection, as he is pin-toed; and he did not look well in his slow paces, being very lame from pulling a shoe off in the horse-box in coming. We could not form an opinion of his trotting action. No. 16 was third; a bay horse, with great bone, short joints, and middling action.

The rest we must pass over, although there were some good-looking, but suspicious horses, that would not bear close inspection.

Class 3. *Clydesdale Colts.*—Only three entries, and a very bad class; not a good one amongst them.

Class 4. *Clydesdale Stallions.*—A model class, and by far the best lot of entries that came before us. We had no difficulty in selecting No. 32, a brown 5-year-old horse by the "Prince of Wales," sold three years ago for 1500 guineas to Mr. Drew, of Merrington, and now standing there at 20 guineas each mare. "Never Mind Him" is a fine, flat-boned, active mover, and a well-bred one. No. 34 was placed second; a brown, 8-year-old, good-topped horse, whose feet looked suspicious, having had an accident, we understand. He has stood second at the three or four last Royal Meetings. The remainder of the class were all good, aud well worthy of being Highly Commended.

Class 5. *Suffolk Colts.*—Only two entries, and both very good specimens. No. 39 first.

Class 6. *Suffolk Stallions.*—No. 44 we placed first. He is a deep, short-legged, good horse; we considered this class all good, a great improvement having been made in their legs these last few years.

Class 10. *Agricultural Mares.*—This was a splendid class, 21 entering the ring. After carefully looking them over, we selected 6 mares for the final inspection; and we think it worthy of remark that only one of the six had a foal at foot, and although a grand mare, she had no chance with the mares in-foal; but we would strongly recommend the Society to give prizes only to those with foals at foot, or else give prizes to each in separate classes. No. 93, which we selected for the first, is a bay 8-year-old mare, with a grand head, neck, and shoulders; a little low-backed, and fore-pasterns weak. No. 89 was second; she is a 5-year-old bay mare, with grand back and loins, but wants bone below the knee; it was a pretty close pick between the first and second. No. 95 we placed third; a 7-year-old bay mare, a very useful, short-legged sort, but lacked the quality of the two above her. No. 97 got the Reserve Number, a 9-year-old roan mare, an exceedingly good mover, but lacking shoulders and depth; her legs were also sadly out of order from over-feeding, and she was thoroughly out-classed by the three bay mares above her.

Class 11. *Clydesdale Mares.*—Only 4 shown, and a very good class. No. 101 was placed first. She is a bay, 5-year-old mare, upon short legs; a good sort. No. 102 was second; she is a 9-year-old mare, poor in condition, looked like thin loins, having a big foal to suckle; otherwise she would have run the first mare very close. The remainder were very good mares, but out-classed in size and substance.

Class 12. *Suffolk Mares.*—Only 3 entries, and a most disgraceful class; we would strongly recommend the Society not to give a separate prize in future, but let them compete with the agricultural mares.

Class 13. *Agricultural Fillies, Two Years old.*—No. 112 we placed first; a great, flashy, taking filly, but rather down in the back. No. 107 second; a useful filly. No. 111 third; a grand, useful, black filly, but with very suspicious hocks. No. 108 got the Reserve; a chestnut, which lacked size and bone.

Class 14. *Agricultural Fillies, Three Years old.*—This was a very good class, but having had to call the veterinary in, his report was unfavourable to some. No. 119 was selected for first; a chestnut, with great depth, bone, and action; she will grow into a grand mare. No. 118 was second; a bay filly with great bone, but very flat-sided. The remainder a useful lot.

T. Plowright, Jun.
B. Spraggon.

Remarks by Mr. Biddell.

With Mr. Spraggon's report I generally agree: but to his remarks on Class 10, I should like to add that I should be sorry to see the Gast mares given up, as both the Gast mares and those with foals at foot are important classes; and I would rather recommend that one prize be offered to each class of mares if the Society cannot afford to make two classes of two prizes each.

Mr. Spraggon's recommendations in Class 12 I quite differ with. Had he seen the 21 Suffolk mares, all of one character, led into the ring at the meeting of the Suffolk Society this year, I think he would have thought the breed worthy of a distinct class at the Royal Society's Meetings. They were certainly very badly represented at the Taunton Meeting, but the home of the Suffolk horse is on the light lands of the Eastern Counties; and, considering the distance from Taunton, and the expense of getting there, the small number shown can be accounted for.

I have acted many times as Judge in classes where different kinds of animals have been exhibited together, and can bear testimony to the difficulty—and often almost disagreeable difficulty—in awarding prizes in such classes, that I very strongly recommend the Society to offer their prizes to the different breeds of all animals in separate classes.

First in the other classes come the thoroughbred stallions; but of the nine entries two at least were roarers, and they can scarcely be said, therefore, to come under the designation of "suitable for getting hunters." Old "Citadel," who must by this time know his way to every town in England where prizes are offered for thoroughbred sires, was placed first; but the son of "Stockwell" and "Sortie" does not gain any additional fame by this, considering that his two nearest rivals were "Claudius," a light and very flashy son of "Caractacus," and the Ashgill-bred "Weather Star," now doing duty in Glamorganshire. The owner of the latter lodged a protest against the first prize being awarded to "Citadel," on the ground that he was a roarer, but the case was not re-opened. Of "Eastley," who obtained the reserve number and a high commendation, it is impossible to say much good, for on the turf he never aspired to travel beyond the T.Y.C., and his forelegs are about as bad as they can be. The stallions, other than thoroughbred, suitable for getting hackneys, were more numerous and better of their kind; and it was a good race between "Norfolk Hero," a very compact horse and a good goer, and "Phenomenon," for the red ribbon, which was at last attached to the head-piece of the Lincolnshire stallion. The prizes for pony-stallions, abandoned at Bedford but revived at Taunton, were not all given away, as there were only five entries. "Sir George," as might have been expected, took the first prize to Westmoreland, for it was a guinea to a gooseberry upon him against the others, though "Cannon Ball," winner of the second prize, can go a bit. The mares in foal, or with foal at foot, were not good in either of the two classes for breeding hunters and hackneys; nor is it necessary to comment upon the five pony-mares entered in the

next class, the only remarkable feature being that they all came from the south-western district, four of them from the immediate neighbourhood of Taunton. In the three next classes for hunter-mares of two, three, and four-years-old, there was next to no competition, as there were only ten entries in all, the first prizes being secured in each case by animals sent from a long distance. "Sunbeam," the 4-year-old winner, was the best of the whole bunch, and the Judges at Taunton only confirmed a verdict which had already been given in her favour at Alexandra Park last June. The 4-year-old hunter-geldings were so bad that the Judges only gave one prize, and this was to "Kelly," who will never do Mr. Battams such good serviee as "Palmerston," whose own brother was placed third in the 5-year-old hunter (mare or gelding) class. This was also a moderate class, and Major Barlow with "King Charming" turned the tables on "Jester," who was second only at Taunton, after beating the Suffolk horse at Alexandra Park. "Jester," though somewhat coarse about the head, and looking more like a charger than a hunter, has had a fair share of success this season; but he is not an every-day sort of horse, and "going the circuit" seems to have told upon him. Whether he could obtain a certificate of soundness is a point upon which I do not feel that it is my province to dwell. A Horse-Show in which Mr. Armstrong did not exhibit "Banker" or "Cashier," would be like 'Hamlet' with the part of the Prince left out. Not that either of these horses is such a paragon of excellence; but they have got up a name for themselves, and everybody seems bound to admire them, and point to them as patterns of what a weight-carrying hunter should be. It would be unfair to say that their capabilities have been tested only in the ring; but there can be little doubt that "Banker," who won, and very deservedly won, the first prize in his class at Taunton, has secured more prizes through his perfect action than anything else. A local man won the first prize in the 12 stone hackney class; and Mr. Gorvett's "Highland Mary" was the best of a very moderate lot. This is about all that need be said of this and the next class, for hackneys up to not less than 14 stone, there being only five entries in the latter. It is surprising, upon first thoughts, that here, in the neighbourhood of Exmoor, there should have been so poor a show of ponies; but it appears that many of those who formerly bred those hardy and handy little animals have either reduced their droves, or given up the ponies in favour of sheep. Mr. Knight, who used to breed such large numbers, lost a great number during the terrible winter of 1860–61; and if he was so unfortunate, it may be inferred that the "little men," with less means of procuring them food and shelter, fared still worse. It would not be going beyond the mark to assert that their numbers have diminished

fifty per cent. within the last fifteen years. This will, in part, account for the comparative failure of the two classes of ponies above and under thirteen hands; and it is no reflection upon the Judges to say that the bay Exmoor gelding, with which Mr. Drew, of Kenton (Exeter), took second prize, was the nicest of them all. He had not quite so much style as "Tally Ho," who won the first prize for Mr. Davey, but his action was better when the pair were seen going together. There were only two jackasses in the yard, according to the catalogue, and their presence could have been dispensed with. Mr. Pease, of Darlington, offered special prizes for these animals, and also for mules. There were four entries of these latter, two being sent by Mr. Pease himself. The Judges, though they did not give him a prize, allowed him to take back part of the hundred pounds which he had offered; for, while there were only two entries of jackasses, they did not award a third prize for mules. This was rather a reflection upon Mr. Pease's two mules, though it must be admitted that they did not bear comparison with those exhibited by Mr. Sutherland, who had secured the mule-prizes with this same pair at Alexandra Park. They have wonderful size and substance, and it is easy to believe that they can do as hard a day's work as an average carthorse. Whether they are more than exceptional specimens of their kind is another matter, and in any event I do not suppose that mules are likely to supplant the Suffolks and Clydesdales.

In appending the Report of the Judges, which did not reach me until the above had already been written, as was the case with the agricultural horses and the Herefords, I can only regret that it is not more ample, for the little which the Judges do say is said so well, that one cannot help wishing for more.

Class 7. *Thoroughbred Stallions for getting Hunters.*—No. 48, "Citadel," as last year, was a long way before the rest of the class, which we considered poor, with the exception of the prize-horses.

Class 8. *Stallion for getting Hackneys.*—This was a good class. No. 57, "Norfolk Hero," is a very beautiful horse, and "quite the sort." No. 64, "Phenomenon," is a very promising young horse, and will hold his own in any Showyard. No. 68, the third prize, may be expected to improve, as he is only three years old.

Class 9. *Pony Stallion.*—Beyond No. 73, "Sir George," so well known at these Shows, and who had a very easy win, there was nothing worthy of a prize, and we should have been justified in withholding second, as well asthird prize.

Class 15. *Hunting Brood Mares.*—This was only a moderate class, and very far behind the grand show at Bedford last year in the same class.

Class 16. *Hackney Brood Mares.*—A good class, and not much to choose between the winner of first prize, No. 135, and the second prize, No. 138; both beautiful movers, each with good foals.

Class 17. *Pony Brood Mares.*—A small and moderate class, but the winner of first prize, No. 143, is a beautiful mare, and had a good foal by "Odd Trick."

Class 18. *Hunter Filly, Two Years old.*—Only two exhibited, and neither worthy of special remark.

CLASS 19. *Hunter Mare, Three Years old.*—Another small class, three only; but No. 148, "May Queen," is a beautiful mare; and if "Honesty," who was sent abroad last year, can get a few more like her in Russia, he will prove a very cheap horse, and a loss to this country.

CLASS 20. *Hunter Mare, Four Years old.*—A small but good class. No. 150, "Sunbeam," is a very beautiful mare, now probably at her best: she gallops with rather round action. No. 152, to whom we awarded second prize, is a very useful mare, and a credit to her sire and dam, both well known in the Showyard.

CLASS 21. *Hunter Gelding, Four Years old.*—A wretched class; so bad that we only awarded one prize to No. 158, "Kelly," a fine galloper, and up to weight, but a very bad mover in his trot.

CLASS 22. *Hunter, up to* 12 *stone.*—This was a good class, as it contained "King Charming," No. 164, winner of first prize, and "Jester," No. 168, placed second. Both horses are good ones in their way, but both are not without faults. No. 165, third prize, might very well have been in the heavy-weight class.

CLASS 23. *Hunter, up to* 14 *stone.*—No. 170, "Banker," won very easily. He is as grand a horse as a man can find. No. 174, second prize, and No. 172, third prize, are nice horses, but not of the same class as "Banker."

CLASSES 24 and 25. *Hackneys.*—Both moderate classes.

CLASS 25.—Wretched in the extreme.

CLASS 26. *Pony, under* 14 *hands.*—This was a well-filled class, and contained some very useful ponies. No. 207, "Tally Ho," was a long way superior to the rest of the class.

CLASS 27. *Pony, under* 13 *hands.*—Another good class, and larger entry; one of the best classes we had before us. No. 228, the first-prize pony, is a very good mover, and quite a pony. No. 218, is a very handsome little fellow, with not such good action as No. 225, third prize, but with better shoulders.

CLASS 28. *Jackass.*—We were not prepared to find the jackasses allotted to us, and when two—a grey and a black—entered the ring to compete for 50*l.*, we could not help exclaiming, "What money thrown away!"

CLASS 29. *Mules.*—50*l.* again to be awarded between four entries; two "not for competition." Here we awarded the first prize to a *brown* mule in preference to a *grey* one, although both were equally good movers. Surely this class might be called Mr. C. L. Sutherland's *benefit!*

T. HARVEY D. BAYLY.
ANTHONY L. MAYNARD.
ROBERT G. F. HOWARD.

CATTLE.

Turning from the horses, it may be as well, in the first place, to hear what the Judges have to say about the Shorthorns.

Though the Show muster was not a large one, the quality of the Shorthorns, the Devons and the Herefords, left little to be desired. *Primus inter pares*, the Shorthorn holds first place in the catalogue, and attracts the largest share of public notice. Of the Shorthorns exhibited at Taunton, the Judges, though their work was prolonged until far in the afternoon of Monday, have little to say, their Report being compressed into the following few lines:—

The Judges of Shorthorns have to report that the various classes exhibited at Taunton may be said to have quite reached the average standard of merit, though their numbers were somewhat smaller than we usually find at the Meetings of the Royal Agricultural Society of England. Both amongst males and females there were many animals first rate in every respect, and in the class for old cows there was such a good show, that the whole class was commended.

THORNEY GOW,
H. CHANDOS POLE GELL,
JOHN WOOD.

The most noticeable feature, perhaps, in the show of Shorthorns was the great success achieved by Mr. Alexander H. Browne, who took the first prize in each of the three classes for bulls to Northumberland. Mr. Browne won the first prize for bulls of over three years with his roomy and particularly stylish "Duke of Aosta," who was successful at Bedford last year in this class, but who has not been knocked about the country this year, as was the case with many of his rivals at Taunton. The "Duke" shared with his owner, Mr. Browne, the honours of the next two classes; for in the 2-year-old class the Judges gave first place to "Rosario," a son of "Duke of Aosta," while "Pioneer," another of his progeny, was awarded first prize in the yearling class. This last-mentioned award was called in question by several of the outsiders, who seem to make it their business to judge the Judges, and to pick holes in every verdict which does not happen to fit in with their preconceived notions. It is as impossible as it would be undesirable to put down the criticism of irresponsible persons; but many of them would do well to remember that the Judges, though they may have the misfortune to differ with them as to a beast's points, are not necessarily on that account ignorant, prejudiced, and unfair. There has, of late, been far too much licence in the language used by the judges of the Judges, not only at the Royal, but at other Shows, and it has done a good deal towards embittering the controversy concerning rival strains of blood. "Sir Arthur Ingram," a much younger bull than "Duke of Aosta," was second to him in the class for bulls of over three years; and "Rosario's" nearest rival was Lady Pigot's "Rapid Rhone," a useful, but not particularly handsome bull, whose grand-dam is by the "Warlaby Valasco." "Baron Irwin" was third in this class; and Colonel Loyd Lindsay's "Prince Rupert," who did not seem up to concert-pitch, was passed over by the Judges. The Lockinge herd was not more fortunate in the class for yearling bulls, as "Lord Rockville" only received a commendation, the race for first honours being between the small but very compact "Pioneer," and the more roomy bull, "Duke of Chamburgh," who, however, had to give way to the son of "Duke of Aosta." "Royal Irwin," by

the same sire, as the third-prize winner in the last class, was third, beating "Lord Rockville," who was in front of him at Croydon. Mr. Denis de Vitré won the first prize with his bull-calf "Duke of Ock;" but "Hudibras," with whom Mr. Oriel Vivcash came second, may reverse places with him when another year is over their heads. In the female classes of Shorthorns there were many good animals—a few extraordinarily good ones. The cows above three years of age took the Judges' fancy so much that they commended them as a class; and as Mr. Outhwaite's "Vivandière" did not, though entered, come to Taunton, the way was made comparatively smooth for "Lady Playful," who is familiar by this time to most of those who attend the principal Shows. It was impossible to help admiring the roan "Alexandria," who took second prize, with her great roomy frame, upon which, perhaps, there is already rather too much of the meat which is more in its place at Bingley Hall and Islington than in the yard of the Royal. In the 3-year-old heifer class Mr. Hutchinson was second with "Lady Alicia,"—a heifer going back by "Lady Playful," through her grand-dam to "Baron Warlaby" and "Vesuvius"—to Mr. Kennard, whose "Queen Mary" was here, as everywhere, the perfection of Shorthorn beauty, and not to be dislodged from the first place of which she has the monopoly. Of the twenty heifers exhibited in the yearling class, the three Croydon winners were again "placed," "Zvesda" being once more first; but "Olga" was put back behind "Winsome 16th," whom she beat at the Bath and West of England Show. There were many good animals in the class for heifer calves, the Judges giving Mr. Nicholson the red ribbon for his dainty heifer "Laurel 6th."

Much less numerous, of course, than the Shorthorns, the Herefords were, however, very well represented in point of quality; and if the Society offered "champion prizes," Mr. Carwardine's beautiful heifer "Helena," winner of the first prize in the yearling class, would have been difficult to beat, for she has not a bad point about her. After winning at Bedford and elsewhere last year, she came out at Croydon in June, and again took first honours; but she was seized with illness there, and it is wonderful that she should have been brought round so rapidly as to be able to appear in the bloom of condition at Taunton. It has been said that the Herefords are much cultivated in Somersetshire; but the truth is that there is probably no western county in which the whitefaces make so small a show, unless it be Cornwall and Devon. This was made pretty clear by the fact that of the fifty-eight Herefords entered at Taunton, only eight belonged to Somersetshire breeders, and of these Mr. Peren, who shows all the country over, owned seven. The male Herefords

were not nearly so good as the females, the best of the bulls being, beyond any doubt, the 2-year-old "Tredegar." First in the yearling class at Bedford last year, and first again this summer at Croydon in the 2-year-old class—winning there also the Champion Cup as the best animal on the ground—he has already had a distinguished career, and will carry off a lot of local honours in the autumn. The old cows were so excellent that the Judges commended all the six animals in the class. In the 2-year-old heifer class there were only four entries; but they were all of good quality, though nothing near the yearling class in which "Helena" was such a good first. Mrs. Edwards owned the best of seven very sweet heifer-calves under twelvemonths, and her "Mabel," who, like "Helena," had won first prize at Croydon, promises to develop into a grand cow. There will be a larger show of Herefords next year at Birmingham, beyond all manner of doubt; but it is scarcely to be hoped that, in the female classes at least, the quality will be better than it was at Taunton. The Judges' Report says:—

We have very great pleasure in acceding to your request that we should send you a few Notes on the Show of Herefords exhibited at the recent Meeting of the Royal Society at Taunton.

In CLASS 38 — *Aged Bulls* — the animals which put in an appearance were, as a whole, remarkably good. The first prize fell to Mrs. Edwards's "Winter de Cote," a very grand level beast, heavy fleshed, beautiful quality, capital colour, and good constitution. Mr. Bailey, of Rosedale, was second with a very promising bull, "King of the Dale," excellent in outline, true table back, very deep before, but a trifle deficient in his hind-quarters. Mr. Spencer's "Von Moltke" secured third honours. He possesses fine character and quality, deep before, with heavy hind-quarters; but we have seen him more in bloom than he appeared at Taunton. The Reserve Number in this Class was Mr. Warren Evans's "Von Moltke 2nd," a lengthy animal, with all the characteristics of a well-bred beast.

In CLASS 39—*Two-Years-old Bulls*—the first-prize went to Mr. Taylor, of Showle Court, with "Tredegar," a very grand beast; the true type of a pure Hereford. He took the Challenge Cup at Croydon, and Mr. Taylor may well feel proud in the possession of such an animal. Mr. Harris's "Prince Arthur" obtained the second prize—he is of good quality. The third prize was awarded to Mr. Reece Keene's "Sir Boucher," an animal with a fair back and capital head.

In the Class for *Yearling Bulls* (Class 40) Mr. W. Judge's "Lord Wilton" was adjudged the first prize; a very good bull, and likely to be heard of again. He has a good back, deep, well sprung in his ribs, and heavy fleshed. Mr. Davy's "Lord Compton" took second honours. Mr. Turner's "Viceroy" is a little deficient from his hip to rump, but is otherwise a fair specimen. The Reserve Number, Mr. Taylor's "Big Boy," has plenty of quality.

In CLASS 41—*Bull Calves*—Mr. Taylor's "Taunton" is a very useful, heavy-fleshed, growing calf, requiring a little time to furnish. Mrs. Edwards's "Sir Edward," which obtained second prize, is a very good specimen, of nice colour, and will be heard of hereafter. Mr. Philip Turner's "Constantine" was the Reserve Number in this class, and a promising calf.

The *Cow Class* (42) was a very grand one; the whole of the animals exhibited being especially good. Mr. Thomas Fenn took first prize with a

ery beautiful cow, possessing great scale, fine character, and heavy flesh. Ir. Thomas's "Rosaline" is a very nice cow, but did not appear quite so looming as on some previous occasions. Mr. Burchell Peren's "Rosalie" is f very good quality and character.

In Class 43—*Heifers in-Milk or in-Calf*—the place of honour was ecured to Mr. James's "Rosebud," an extremely beautiful, short-legged, atin-coated heifer, of fine quality and character. She is unexceptionally erfect. Mr. Philip Turner's heifer is also an unquestionably grand specien, with plenty of scale, flesh, and quality. Mr. Harding's "Lady Annie" eserved the third prize, although Mr. Peren's "Compton Rose" trod closely pon her heels.

The *Yearling Heifer Class* was very good indeed. The first prize was aken by a splendid heifer of Mr. T. G. Carwardine's. She is as nearly perfect s may be, very level, with beautiful character, and superb quality; with ge she will tone down into perfection itself. Mr. Taylor's "Cherry" is an xceedingly nice heifer, full of quality. Her Majesty's "Duchess of Edinurgh" is a heavy-fleshed, good quality heifer; and Mr. Evans's "Lady lanche" (the Reserve Number) possesses fine character, and is very promising.

In Class 44 Mrs. Edwards's heifer-calf, "Mabel," has plenty of quality and ood hair, rich in colour; likely to make her mark in the future. Mr. eren's "Lady Lottie" promises to grow into a show animal. Mr. Turner's Constance" was the Reserve Number in this class.

Our remarks must end here. The Herefords as an entire lot were—if not uite so numerous as on some former occasions—certainly not behind any revious exhibition for their general excellence. Undoubtedly the prevalence f foot-and-mouth disease kept many of the best specimens of Herefords at ome; but we must emphasise our report by adding that the animals shown istained the reputation of the breed, and afforded another proof, if, indeed, ich were needed, of the great superiority of this breed for its aptitude to evelop into early maturity, for its general hardihood of constitution, its apacity to thrive in all climates, and for its unquestionably pre-eminent dvantage in being able to lay on more flesh in a given time, and with a given uantity of food, than the animals of any other breed.

Wm. Taylor.
Thos. Rogers.
Richd. Bach.

It is personally gratifying to me to find the Judges of Devons, hile they praise the animals exhibited at Taunton, reporting: We feel it necessary, however, to remark that a great number f the cattle exhibited as Devons do not possess the true North Devon type in any respect except that of colour." There is no eed, as the Judges say, to disparage the larger breed, whose more oomy frames may be well suited to the rich grazing land for hich Somersetshire is famous, but it may be asked whether the me has not come to establish separate classes of Devons? It s invidious for a Judge to be called upon to decide between the nerits of two animals so utterly dissimilar as one of the great Devons, of which there were so many at Taunton, and one of ne dainty North Devon type, with which the Quartly herd was lways so successful. I called the attention of more than one xperienced judge to the apparent coarseness of many of the Devons; but I was met by the reply that the time had gone by

for fancy breeding, and that without size and substance the Devons could not be made to pay. There may be much force in this objection; and the great roomy animals which are reared in the Somersetshire pastures are doubtless well suited to the soil; but that is no reason why they should be confounded with the smaller cattle which represent more faithfully the Devon of five-and-twenty years ago. Lord Falmouth and Mr. Farthing had the game pretty well to themselves in the three first classes for Devon bulls; but none of the animals exhibited in these classes were of exceptional merit, and the best of the male Devons were to be found in the class for calves, Mr. Smith's "The Earl" and Sir Alexander Hood's "Robin Hood" being quite worthy of the encomiums passed upon them. In the class for older cows, in which what the Judges term "the Somerset Devons" predominated, there was a good muster, and "Lovely Queen," winner of the first prize would, but for her indifferent hind-quarters, be a perfect specimen of her race. Sir Alexander Hood was again second here with his "Lovely;" but Mr. Farthing's cow, "Nellie," which took first prize at Croydon, did not get beyond a high commendation. The heifers in-milk not exceeding three years old were good though not numerous; while the yearling heifers were not only a very large class, but, beyond all manner of doubt, the best Devons in the yard. Her Majesty the Queen won the first prize with a beautiful animal, full of style and substance, while another animal from the Norfolk farm came in for high commendation. Mr. Trevor Lee Senior may think himself fortunate in getting the third prize here, for his "Moss Rose the Second" looked more like the shambles than the paddock. But only too many of the Devons, Shorthorns, and Herefords were overdone; and it is easy to foresee that, at the present rate of progress, the day is not far distant when the Judges will have to be preceded by the Society's veterinarian, or by a competent and impartial butcher. The same Judges who awarded the prizes in the Devon classes looked over the Sussex cattle; but this part of their task was a very easy one, for the Sussex breed has fallen on evil days. What with the foot-and-mouth disease, which has played such havoc with them, and the distance at which the Show was held from their home, the entry was a poor one, and of the twenty entries more than half were not sent. It is true that the number and value of the prizes given for Sussex cattle is less than is offered for most other breeds, and this may have had something to do with the miserable competition in these classes. The Judges of Devons and Sussex cattle write as follows:

The Devon classes were nearly all well filled, and some of them contained animals of very great merit. We feel it necessary, however, to remark that a

great number of the cattle exhibited as Devons do not possess the true North Devon type in any respect except that of colour. We do not wish, in any way, to disparage the larger breed which may, perhaps, be called Somersetshire Devons. Many of them have large frames, with great aptitude to fatten, and are well calculated to graze and fatten in the rich districts of the vales of Taunton and Bridgwater, and other localities where they are bred; but when animals, in many respects so dissimilar, are placed in competition, a task is imposed upon Judges which it is impossible for them to fulfil with satisfaction either to themselves or to the exhibitors. In making our awards on Monday last we do not hesitate to say that we adhered as closely as we could to the North Devon type; but we nevertheless feel that several remarkable beasts, both male and female, were passed over without prizes, which we think they deserved, but which, to be consistent in our judgment, we could not bestow upon them. We are strongly of opinion that the time has arrived for the Council of the Royal Agricultural Society to consider this question with a view to a different classification of the Devons. In illustration of our meaning, we would point to the great improvement and development of the Channel Islands Cattle, which has resulted from a better classification of breed; and we believe that a similar and rapid improvement would take place in the Devons generally with a better classification.

We remark upon the different classes as under.

Class 46.—A fair class. The prize animals good useful bulls, but not equal to the best of some former exhibitions.

Class 47.—A very fair class, and although not any very striking animals, nearly up to the standard of former years.

Class 48.—A very indifferent class. The first-prize young bull was a good one, but all the others were inferior.

Class 49.—A good class, with several nice promising bull calves.

Class 50.—A large class of good cows, but the true North Devon type did not prevail, the majority being the large Somerset Devons.

Class 51.—A class of very good heifers, with great size and substance.

Class 52.—A large class, with several very superior animals, and, on the whole, the best collection amongst the Devons.

Class 53.—A small class, with two or three promising young animals.

Sussex Cattle.

The Sussex breed was badly represented, and in several classes there was scarcely any competition.

Class 61.—A pretty good class of large useful bulls.

Class 62.—Only two animals exhibited, and the second prize was not awarded, as we did not think there was sufficient merit to justify a special recommendation.

Class 63.—Only one cow exhibited.

Class 64.—Only one heifer exhibited.

H. W. Keary.
John Overman.
James Quartly.

Channel Islands Cattle.

There was a better show of Jerseys, if not of Guernseys, at the Essex County Show than at Taunton. Such, at least, was the opinion of several people who had come on from Brentwood to Somersetshire; and it must be admitted that some of the

Jerseys exhibited at Taunton were not very bad to beat. Not but what there were one or two good animals, notably Mr. Wingfield Digby's first-prize 2-year-old bull, and Mr. Christopher Power's cow "Victoria," which had not to meet Mr. Simpson's "Buttercup," who beat her at Brentwood. But most of the Jersey cows and heifers were far too fat. A very old breeder of Jerseys declares that colour will kill quality, and that, though the colour mania is not quite so prevalent as it was two or three years ago, people still set far too much store by it. A Jersey, to be a good milker, according to this same authority, should be thin in front, like a racehorse, and corpulent behind; especial attention being, of course, given to the shape of the udder. And, in connection with the milking qualities of the Jerseys, it may be mentioned that every cow of the Channel Islands breed was milked dry on the Sunday evening in the presence of an officer of the Society specially appointed for that purpose. This enabled the Judges to estimate very accurately the respective milking qualities of each cow. If the Jerseys did not come very well out of the ordeal of judging, the Guernseys received the best of characters; and Class 59, for cows of above three years old, contained nine animals which gave the Judges a deal of trouble. Four cows in this class were commended, in addition to the two prize-winners. The heifers, in-milk or in-calf, not over three years, were not less taking as a whole; though "Snowdrop," who took the first prize, was far in advance of all the rest; she, like the yearling Hereford heifer, being very near perfection. It must be added that the judgments given at Croydon, where the Guernseys also showed in great form, were in not a few instances reversed at Taunton; but some of the critics who found fault with the Taunton decisions might have remembered that in the interval of six weeks there had been ample time for the Croydon winners to go off, as one or two of them unquestionably had. In an exhaustive Report upon the Channel Islands Cattle, the Judges say:—

The growing interest taken by amateurs and stock-breeders in these classes has greatly influenced the competition at the Annual Meeting of the Royal Agricultural Society.

With reference to the stock submitted to us at Taunton, we would beg to report as follows:—

Jersey Cattle.

Class 54. *Bulls above Two Years old.*—In this class there were ten entries. The first prize was awarded to No. 500, a neat and well-bred bull of good quality. The second was taken by No. 503, a large, square, and powerful animal, but rather too heavy about the head and throat. No. 502 ran the former closely for place, but ultimately came in for the third prize; whilst the reserve was given to No. 495, an animal of riper years, but retaining

much liveliness and activity. Though small for his age, No. 501 was considered worthy of commendation.

CLASS 55. *Bulls above One and not exceeding Two Years old.*—In this class there were but three entries. No. 504, a good and promising animal, took the first prize. No. 505, which came in for the second, though of a fanciful, and perhaps what might be styled a fashionable colour, carries a bad head, and in excellence was far behind his rival.

CLASS 56. *Cows above Three Years old.*—Eleven animals entered for competition. No. 516*a*, an aged, but a rich and well-framed cow, received the first prize. No. 514, though a little plain about the head, was the type of a rich milker, and deservedly came in for the second place; and to No. 509, a small, but certainly good animal, though somewhat too heavy in the head, the third prize was given; the reserve falling to No. 513, which, for its merits, was highly commended. The animals above mentioned, as milk and butter-producers, could not be mistaken. No. 515, a pretty cow, was commended, but this animal showed rather a tendency to form flesh than to supply the pail. So much flesh on a cow in-milk a few months after calving is not indicative of being a good dairy animal.

CLASS 57. *Heifers in-Milk or in-Calf, not exceeding Three Years old.*—In this class there were eleven entries, most of which were decidedly good. The first prize went to No. 524. Here there was unmistakeable richness. The skin and horns were of that yellow colour which invariably denotes richness of produce; besides which, her well-formed frame stamped this heifer at once as the best of the class. The second prize was awarded to No. 525, a young animal of very promising appearance; and the third to No. 518, which was also good, but would have been still better had she shown a more yellow skin. No. 519, the reserve, would have held a higher place in this class had she shown her teats to better advantage; these, when the animal was exhibited in the ring, were sadly distorted, possibly through the udder not having been milked as it should have been, the udder itself being distended greatly; but taking into consideration the other merits of this otherwise pretty animal, she was highly commended. No. 526 was also highly commended on account of its beauty; but the Judges desire to point out that in this heifer the meat-producing type was also too strongly marked for her to be deserving of a higher place.

GUERNSEY CATTLE.

These classes were exceptionally good. In CLASS 58—*Bulls above One Year old*—seven animals competed, the first and second prizes falling respectively to Nos. 533 and 534. The former very good, straight, and well-formed throughout; the latter with a beautiful forehand, but in its hind-quarters not so equally well formed. No. 531 was placed as the reserve; this animal, evidently well bred, lacked neatness about the head and horns. No. 532 was also commended.

CLASS 59. *Cows above Three Years old.*—Nine animals were entered, which, as a class, deserve special notice. The prize animals, Nos. 542 and 538, were grand animals. The reserve, No. 539, also a very beautiful cow, lacked in the fore-part of the udder, which was not sufficiently well thrown forward. No. 535, not in-milk, showed every sign of richness, and was commended. No. 537 was also deserving of commendation; and No. 543, though not so well formed, was considered deserving of commendation.

CLASS 60. *Heifers not exceeding Three Years old.*—This was also a very good class. No. 553 took the first place easily. It would be difficult to meet with a more beautiful animal of this breed. No. 551, which came in for second honours, is also a good, strong, and promising animal. No. 550 was placed as reserve; here is the type of a good milker. Commendations

were given to Nos. 552 and 535; the former showing a good frame, but her udder does not sufficiently run forward. The latter was good in many respects, and would be still better if her teats were more squarely placed.

Such is our opinion on the classes which have been submitted to our consideration and judgment; and with the hope that our opinions on the merits of Channel Islands Cattle will be satisfactorily received, we would beg to point out that in our awards we have strictly considered the stock in reference to its great speciality, viz. richness of dairy produce, combined with beauty of form, and free from all fanciful ideas of colour, &c. In short, we have suspiciously regarded animals in-milk, however beautiful to the eye, if the tendency to show flesh was too prominently developed.

We would beg emphatically to point out that every encouragement should be given to increase, and if possible to improve, the produce of the Jersey and Guernsey Cattle as dairy stock; and whilst endeavouring to combine with these great properties beauty of form, set aside from the prize-lists such animals as do not possess the staple qualities which have established the reputation of the Channel Islands Cattle.

Walter Gilbey,
Chas. P. Le Cornu, } Judges.

Sheep.

When several exhibitors complained at the General Meeting of Members held in the Showyard, that they were not allowed to trim their sheep after they came into the yard, they only touched upon a question which has given rise to much debate, and which cannot be settled satisfactorily except by the laying down of regulations which shall be adhered to most scrupulously. The Inspectors of Shearing and Colouring make the following recommendations:—

We, the Inspectors of Shearing and Colouring of Sheep, find that very many sheep have had oil, grease, and colour, applied to them. The selection is difficult, as such application has been used to a considerable extent by Exhibitors, and to condemn the numbers as named here—Nos. 583, 591, 607, 608, 642, 643, 644, 900, 901, 909, 910, 911, 912, 913, 914, 921, 923, 924, 925, 926, 927, 931, 933—would not be fair as compared with others not mentioned. We would strongly recommend the Stewards not to disqualify any this year, but to frame the conditions of Show in this respect for 1876 in such a way as to prevent the use of oil, grease, or anything whatever to affect the colour and quality of the wool. The only sheep we doubt of being unfairly shorn is No. 643. We recommend the Stewards to pass this one also, and we will in our Report endeavour to show good grounds for the recommendations given.

William Jobson,
J. B. Workman,
W. R. Shittler, } Inspectors of Shearing and Colouring.

In that Report these gentlemen say:—

"We, the Inspectors of Shearing, were anxious to carry out the regulation of the Council as to oiling and colouring, but we found too much difficulty in satisfying ourselves in many cases that this had been 'unfairly' done. After much consideration, we came to the conclusion that it was impossible to give effect to the regulation absolutely; that if attempted we should inevitably disqualify some of the entries unjustly, while others offending against the

regulation would escape; we therefore determined not to disqualify any sheep for being coloured or oiled.

The Inspectors hope that the Council will see that they adopted this course with no desire to avoid the duties imposed upon them, but only because they feel the impossibility of so performing them as to satisfy themselves that they were dealing justly with the exhibitors.

The shearing we found quite satisfactory.

There being such a few lots of wool exhibited we see nothing worthy of any comment."

Not only were the entries in the sheep classes very much below the average, but the number of exhibitors was surprisingly small, being but 73 in all: 21 of Shropshires, 11 of Lincolns, 10 of Devon Long-wools, 9 of Southdowns, 6 of Leicesters and Oxfords, 4 of Cotswolds, 3 of Exmoors, 2 of Dartmoors, and 1 of Devon and Somerset Horns. But, so far as quality goes, there was little room for complaint, as it is generally allowed that nearly every breed was well represented, though the palm of merit must, perhaps, be awarded to the Shropshires, of which there was a large, as well as a good show. Of the Leicesters—in which classes Mr. George Turner, jun., has for once met more than his match in Mr. Hutchinson, of Catterick, who seems to be "good all round," for he also took prizes with his Shorthorns, his cart-horses, and his hunters,—the Judges report as follows: —

Class 65.—The sheep that have taken the prizes were very good sheep; the reserve number and the commended sheep were also good; but the remainder of the class was not so good as usual.

Class 66.—The whole of this class was very good, especially the prize-sheep.

Class 67.—The first and second-prize pens were very good lots; the remainder not so good.

Charles Clarke.
Thomas Stamper.
Samuel Field.

The Cotswolds and Lincolns were not very heavy classes, though an exception must be made for Class 71, Lincoln shearling rams, of which there was a strong muster, 22 of the 25 entries coming out of the county from which this breed derives its name. There was not, however, any sheep of surpassing merit in these classes, of which the Judges report:—

The Judges, in Classes 68 to 73 inclusive, are of opinion that no special remarks are called for from them; but they consider that the animals exhibited were very good specimens of their class, which they fairly represented, although in Classes 70, 72, and 73 the number of entries was very short.

Henry Beevor.
John B. Aylmer.
William T. Garne.

Although the Oxfordshire Downs were not represented by a single Somersetshire breeder, there was no lack of competition in these classes, to which Mr. Milton Druce contributed some of

the nicest sheep in the yard. He was first, second, and third with his shearling rams, first and third with his older rams, and again first with his only pen of shearling ewes. The shearling, which had previously made his mark at the Chipping Norton and Croydon Shows, was again first here, and Mr. Druce possesses in him a ram of wonderful merit and of still greater promise. The Judges report briefly on the Oxfordshire Downs to this effect:—

The Judges are of opinion that the Class of Shearling Rams, excepting the prize-takers, was not up to the usual standard.

The whole class of rams of all other ages was exceedingly good.

The same may be said of the shearling ewes.

Henry Overman.
James E. Rawlence.
Henry P. Hart.

Of the Southdowns there is little but good to be said; and with the flocks of Lord Walsingham, the Duke of Richmond, Mr. Rigden, and Sir William Throckmorton well represented, it is not surprising that the farmers of Somersetshire should have declared that they never saw such sheep before. The Merton flock is now quite as good as ever it was in the time of the late Lord Walsingham, whose son was first and second with two shearling rams, and commended with two others. He beat the Duke of Richmond again in the two-shear class, being first and third to the Duke's second; but the Goodwood flock was avenged in the class for ewes, not only keeping Lord Walsingham out of first place, but being highly commended with a second pen. Sir William Throckmorton could only obtain one third prize, and Mr. Rigden was once more beaten pointless; but the sheep which did not get noticed by the Judges would probably have taken prizes at many other Shows, so good were the Southdowns at Taunton all round. The Judges say:—

The class for shearling rams was well filled, and much difficulty was experienced by the Judges in making their awards. They much regretted that they could not feel justified in giving to a sheep of superb quality of mutton and fleece, No. 720, more than a high commendation, on account of an objectionable head.

The class for all other ages contained many very good sheep; whilst the shearling ewes were the best ever seen by any of the three Judges engaged.

Henry P. Hart.
Henry Overman.
James E. Rawlence.

If the Southdowns were good both in respect to quality and substance, the Shropshires were even better; and there is not a single breed of sheep which has made greater or more rapid improvement than this, which, not many years ago, was classed

amongst "other breeds." Lord Chesham has done much for the Shropshires; and the new President of the Society was amply rewarded at Taunton, where he gained the first prize and a high commendation with two shearling rams, the second prize with a two-shear ram, and the first prize with his pen of shearling ewes. Mr. Pulley was third to him in the first and last of these classes, and beat him with a two-shear ram, which had a deal of style, and all the characteristics of the Hereford Shropshires. Lord Falmouth, who carried all before him with his Shropshires at the Truro Show the week after, was not so fortunate at Taunton, for he did not obtain a mention in either of the three classes. The Judges, as will be seen by their Report here appended, are of opinion that the breeders of Shropshire sheep are now pretty unanimous as to the points which they should endeavour to develop in their flocks, and they have already done much to prove that they are likely to attain the summit of their desires:—

Again the breeders of these sheep have contributed largely and very creditably to the Royal Society's Showyard, and the animals they have exhibited testify to the fact that their owners are mainly agreed as to the character they should seek to establish in their flocks. Each year greater uniformity is seen in the pens of Shropshires, and few are shown which do not possess that combination of heavy flesh, strong constitution, good quality of mutton, and heavy wool, which, the breeders of these sheep maintain, enable them to produce more meat and wool, per acre, in districts suited to them, than any other kind of sheep will do. The remarkable way in which they have spread over the Midland Counties during the last twenty years testifies strongly to this; and as they are beginning to find their way into the far north, their patrons believe that their hardihood will enable them to maintain that character there.

The shearling ram class had 54 entries, nearly all of which do high credit to their breeders. The first-prize sheep was an exceedingly good one, combining all the size we want with rare form and quality; the second and third were very good specimens of what Shropshires should be; and the reserve number a little model of form and quality, but wanting that masculine character which a sire of rent-paying sheep should possess. Lord Chesham has in a short time done wonders as a breeder. If he can combine the form and quality of this sheep with the size and grandeur of his first-prize shearling, he will run small risk of losing his present position.

Class 81—*Rams of any other age*—contained 16 entries, and several useful sheep were shown; but nothing in this class calls for any particular comment from us.

In Class 82—*Shearling Ewes*—there were 11 entries. The first prize, No. 841, was a very fine symmetrical pen of ewes; the second prize, No. 843, showed a great deal of character; and the third-prize pen, No. 839, was a very useful pen of sheep. No. 836, the reserved number, contained some good ewes, but not so uniform in character and wool.

Upon the whole we considered the sheep generally bore a favourable comparison with those shown in any former year.

Thomas Horley, Jun.
Charles R. Keeling.
C. Randell.

The Hampshire Downs, and other Short-wools not qualified to

compete as Southdowns or Shropshires, were not very numerous, but the Judges give them a good character. With the exception of the third-prize pen of shearling ewes (Mr. Homer's Dorsetshire Downs), all the prize-winners were Hampshire Downs, and the majority of the awards went to Mr. Alfred Morrison and Mr. Rigg. The Judges' Report is that—

The Hampshire Downs showed in average numbers, and a marked improvement was observable in quality and uniformity of type.

In Class 83 were many superior animals, the first-prize shearling being a particularly smart sheep, well grown, and of excellent quality. The second-prize winner showed great substance and fashionable type; while the third sheep was hardly so neat, but at the same time looking all over like a rent-payer.

Class 84 produced some really fine specimens, the first-prize winner being unusually worthy of merit, with great depth of carcass, good quality of flesh and wool: the second-prize sheep had a rare back, but was somewhat leggy. No. 865, placed third, showed great substance, but was scarcely so symmetrical.

In the Class for Shearling Ewes, No. 870 were of beautiful character, with well-covered backs and excellent form. No. 872, placed second, were of great size, but a little deficient in neck, and rather light about their legs of mutton.

James E. Rawlence.
Henry P. Hart.
Henry Overman.

It might have been expected that the breeds of sheep peculiar to the district would have shown in great force, so far as numbers, at all events, were concerned; but any such expectation was doomed to disappointment. The Somerset and Dorset Horn sheep, noted for their early lambing and for the large proportion of doubles, are very much prized in the south-western counties, and they are eminently adapted to a good deal of the land in the neighbourhood of Taunton. Yet the only exhibitor was Mr. Culverwell, whose flock at Clavelshay, near North Petherton, has not its equal in the county. This, perhaps, was why he had the field to himself; and the Judges thought so highly of his five rams, that they did not withhold any of the four prizes in the two classes, and highly commended the fifth. There was not a single entry of ewes. From Dartmoor, again, we might have counted upon more than the twelve entries made by Mr. Drew and Mr. May, both of whose farms are near Tavistock. Mr. Drew was first in all three classes, and second in the shearling ram class as well, Mr. May being second in the two others. There were only seven entries of Exmoors, and here Mr. Passmore was first in each of the three classes, Mrs. Langdon being second with her two rams; while there was only one pen of shearling ewes. The Devon Long-wools were more numerously represented; but Sir Heathcote Amory and Mr. Corner took nearly all the prizes, though, as the Judges' Report will show,

the merits of the competitors were, for the most part, evenly balanced:—

We are very sorry to see such small competition in the Somerset and Dorset Horns, but what were exhibited were very good, especially No. 876. In the Dartmoor class there were some very useful animals, particularly among the ewes. In the Exmoor classes the shearling rams were very good, and in the old ram class, No. 895 was an extraordinary animal. There was but one pen of ewes, and they were very good. The competition in the Devon Long-wool classes was very numerous, and very close as to merit.

JOHN CARPENTER.
HENRY MAYO.
JAMES W. PAULL.

PIGS.

What might otherwise have been a fairly good show of pigs was spoilt, to a great extent, by the disqualification of the following eighteen pens, because "the state of dentition indicated that they were over the age described:"—

Class 98. No. 938 (pig supposed to have been afterwards removed).	Class 103. No. 968.	Class 107. No. 1010.
,, 102. Nos. 963, 964, 965, 967.	,, 104. Nos. 976, 980.	,, 108. No. 1016.
	,, 106. Nos. 995, 997, 1000, 1002, 1003.	,, 110. No. 1034.
		,, 114. No. 1078.
		,, 116. No. 1087.

As is the case in all dairy districts, there are a great many pigs kept on most farms near Taunton; but their owners do not seem to put a very high value upon them, for not one of the 162 animals entered came from anywhere nearer than Bristol. It was noticeable, indeed, that here, as in the sheep classes, the entries were concentrated within a very few hands, for there were but one-and-twenty exhibitors for all the five breeds. Lord Ellesmere, Mr. Jacob Dove, and Mr. Sexton, divided the honours pretty well between them, Lord Ellesmere taking five out of the six prizes awarded for "other breeds" with his Lancashire whites. His only competitors were Mr. Moir and Mr. Jacob Dove; and the entries were so small that the Judges withheld the second prize in two classes. In appending the Judges' Report on the pigs, I can but express my regret at finding that it is so meagre, the most significant feature in it being the remark that in Class 102 (for boars under a twelvemonth old, of the small white breed), and in Class 104 (for sows of the same breed), there were nine entries disqualified out of thirteen. The Report says:—

Taken as a whole the pigs were a very fine show; but, owing to numerous disqualifications, many good animals did not come into competition.

CLASS 98. Only moderate.

CLASS 99. A fair class.

CLASS 100. A small entry. No competition.

CLASS 101. A fair class.

CLASS 102. Owing to several disqualifications, only three animals were left in competition. A fair class.

Class 103. A very good class.
Class 104. Only one entry left; the remainder disqualified. Fair.
Class 105. A very good class.
Class 106. A fair class.
Class 107. A very fair class.
Class 108. Small entry, but very good.
Class 109. A very good class both in quality and numbers.
Class 110. A fair class.
Class 111. A very good class.
Class 112. Ditto, ditto.
Class 113. Ditto, ditto.
Class 114. No competition.
Class 115. A good class.
Class 116. No competition.
Class 117. A very good class.

Robert Carver.
William Cattle.
L. S. Chrisp.

Cheese and Butter.

There was but a small and indifferent show of Cheese (only seven exhibitors in all), but there was a larger and better display of Butter. In a county to which Cheddar cheese is indigenous, it might have been expected that some very good cheese would have been sent for exhibition; but while the Cheddar cheese is very highly esteemed for its richness and flavour, nothing can be conceived more flaccid and tasteless than the skim-milk cheese which is made in large quantities all about Taunton. In two separate Reports, the Judges of Cheese and Butter, who are unanimous in their praise of the specimens of butter upon which they had to decide upon, write:—

I have pleasure in reporting that I considered the show of *Butter* very good; those to which we awarded the Prizes, as well as those Highly Commended, were of a very superior class, both as regarded quality, flavour, and texture. The Commended I should class as fine quality; and even the poorest samples were, or might be, classed as fairly good. The samples were sent in a creditable state, and some entitling the exhibitors to the possession of artistic merit.

Cheese—only a small supply (seven exhibitors) in the two classes. Quality not fine, nor the samples sufficiently matured.

Jos. Watson.

In reference to the Taunton Show of Butter and Cheese, my idea of that part of the Show was, that the show of *Cheese* was small in quantity, and that the quality of those shown was not very choice.

Butter, a very good show, and the quality very fine of those dairies shown to which Prizes and Commendations were awarded.

R. Clark.

After placing before the readers of the Society's 'Journal'

these brief introductions to the Reports of the various Judges, I cannot better terminate them than by saying how materially I have been assisted: first, by the Stewards of Live-stock, who gave me every facility for obtaining information which it might otherwise have been difficult to procure; and afterwards to the Judges who, once their labours concluded, spared no pains to enlighten me upon points which seemed to need any explanation.

XXII.—*Report on the Exhibition of Implements at Taunton.* By CHARLES WHITEHEAD, F.L.S., F.G.S., &c. (Senior Steward).

THE descriptive Report of Mr. Hemsley upon the trials of implements at Taunton relieves the Senior Steward of Implements from the necessity of saying much with regard to them. His chief duty is now to write something of a valedictory nature, to bid farewell gracefully, like the dying swan, to utter notes as tuneful as possible. The prominent *rôle* has been most properly assigned to Mr. Hemsley, whose music, the click of the mowing-machine, requires merely a preface—the overture to the opera.

At no place has a more kindly feeling been shown throughout to the officials of the Society than at Taunton. The local authorities did their work thoroughly well, and carried out their agreement to the letter. The inhabitants of the town vied with each other in decorating their shops and houses, and at no previous Meeting has a more enthusiastic welcome been given to the Society, or more hospitality shown to the officials connected with it. The Showyard was beautifully situated near the town; and if the rain had not come in such deluges, and been so persistent, it is believed that the financial loss would have been comparatively trifling. Every one knew that a loss was almost certain when Taunton was selected; but judging from the number of visitors who came in on the first half-a-crown day, which was beautifully fine, and the intense interest which they manifested in the stock and implements, there would have been a far larger aggregate attendance than had been thought possible if the weather had been moderately good. It was most interesting and eminently instructive to notice the keen attention of the visitors to the Showyard on Tuesday; the greater part of whom, acccording to the information of one who well knew the locality and its inhabitants, were farmers or connected with

farming interests. These will not quickly forget the lessons taught by the highly finished perfected machines and implements, and the symmetrical models of animals. Evidently they came to see and learn, and to profit by what they might see; not merely to see and be seen, which has appeared to be the chief object of a great proportion of the visitors to some previous Shows; though it must be said, *en passant*, that the ladies among them were well worth seeing, and gloriously and triumphantly maintained the traditional beauty of the dames and maids of the West. Very satisfactory it is to find that the exhibitors and makers of implements drove a good trade and received many orders throughout the week, notwithstanding the wet and the gloomy skies that were enough to damp the ardour of the most weatherproof and enthusiastic agriculturists. Upon the whole, it must be said that, although the Society has sustained a heavy pecuniary loss, it has done a good and great work that will be long remembered, in going to a purely agricultural district, and has imparted a stimulus to the agriculture of Somersetshire.

It was peculiarly appropriate that mowing-machines and haymaking-machines were tried in a grass country; that the fortunate farmers of the rich meadow-lands of Somerset and Devon should have been enabled to see the implements most suited to their requirements exhibited and tested close to their doors. No better trial-ground for mowing-machines could have been well found than the luxuriant meads of Taunton Dene; nor could more patient, more thoroughly competent, more hardworking Judges have been selected than the three gentlemen who toiled indefatigably from early morn till dewy eve during the whole term of the thorough investigations that have probably settled the question of supremacy, and obviated the necessity of further trials of machines connected with grass land, at least for many years. The land placed at the disposal of the Stewards by the local authorities was most conveniently situated. The fields were of suitable size and shape, while the crop of grass was in most cases quite heavy enough to try to the utmost the capabilities of the various machines, especially in the clover, which was a very stout crop, much twisted and laid in places. Yet one exhibitor, who had entered several machines, withdrew them finally from trial-competition for the alleged reason that the crops were not heavy enough to afford a sufficiently severe test of their capabilities. Very fortunately for the competitors, Judges and Stewards, and all engaged in the trials, the weather was fairly fine during the greater part of the trial-week, though it was stormy and wild occasionally. This served to vary the cloud- and land-scapes on the beautiful ranges of hills enclosing

the valley of the Tone like a large amphitheatre, now bathed in sunshine, now clothed with silver-lined shades. Had the rain come down then as piteously as it poured during the following week it would have been impossible for the Judges to have performed their task during the allotted time. As it was, *favente Jove*, they barely got through their work, and could not give their awards in until late on Monday the 12th, though there were but few hindrances, and everything worked smoothly and well. The local committee had done all in their power to make satisfactory arrangements for the trials, and carried out thoroughly well the details of the duties they had undertaken with regard to them and the Show generally. The trial-fields had been arranged and marked out by the Stewards; and some were measured off on Saturday, the 3rd of July, in order that the Judges might be enabled to commence proceedings the first thing on Monday morning, instead of having to waste the best part of the first day, as has happened upon some former occasions, waiting while these preliminaries were settled. Arrangement of these details in order that the Judges may begin their work at once, either of inspection of the parked implements or of actual trial, entails the attendance of one or two of the Stewards a day or so earlier at the scene of action. The advantages are so obvious, and so great to the Stewards themselves and to all parties concerned, that it is hoped that they will not mind this slight inconvenience, and will always arrange that everything shall be in order for the Judges when they assemble. Most of the machines for trial were parked on Saturday inside the Showyard, conveniently close to the gate nearest to the fields. The Stewards wished to have them parked in the fields; but upon the representation of the exhibitors that they would be exposed to mischievous or malicious damage during Sunday, and considering the close propinquity of the trial-fields, they consented that they might remain in the Showyard, parked near the gate. Much valuable time would be saved if, in cases like Hull and Wolverhampton, for example, where the trial-fields were a long way from the Showyard, the implements for trial were parked in the trial-field before the Judges began their labours.

At this time, when the manufacturers of implements and others are doubting the necessity for further trials of standard or ordinary agricultural machines and implements, it will be satisfactory to those who believe that the trial system should be continued, to note that the number of mowing-machines that competed at Taunton was considerably greater than at Manchester or Plymouth. There were 35 two-horse mowers in competition at Taunton belonging to 18 exhibitors. At Man-

chester 13 exhibitors sent 23 machines for trial, while at Plymouth only 13 machines competed. This seems to indicate that the exhibitors, as a body, have not lost their zest for a hardly fought contest in the fields, nor their faith in the efficacy of trials, and in the genuineness, thoroughness, and importance of those conducted by the Royal Agricultural Society of England. It may be urged by objectors to the system, "*Cui bono?* In what have these recent trials resulted? Messrs. Hornsby's machines took the prize at Manchester, and the same firm have carried all before them at Taunton." The inference that these objectors wish to be drawn is that there have been no material alterations in mowing-machines since the Manchester Meeting. Mr. Hemsley's report answers this: Whoever runs may read, great improvement in detail, in arrangement, in adjustment of important parts, in draught, though the principle is the same, and will remain the same, *per omne volubilis ævum.*

The renewed trials of haymakers and horse-rakes are possibly not so intelligible or so defensible, though from the wretched work done by many of the horse-rakes it would appear that they have not yet been levelled up to the mark by a long way. Still the principle of the prize implements in this class was perfect, and the work performed by them thoroughly satisfactory. Mention has been made above of the withdrawal from competition of four mowing-machines at Taunton at the eleventh hour, for reasons which have been well characterised as "unfortunate." In the class of haymakers and horse-rakes several exhibitors who had entered implements failed to put in an appearance at all. The representative of one well-known firm, whose implements, duly entered for trial, were actually upon the trial-field, refused to allow the Judges to try them, alleging that he had received strict orders from his employers that they were not to be tried. The Stewards, of course, ordered these implements to be tried forthwith. It is not fair to the Society to enter implements for trial and to withdraw them at the last moment. An exhibitor is not justified in taking this course except under very exceptional circumstances. Arrangements are made by the officials of the Society at much expense and trouble, based upon the number of entries, which are frustrated in degree by the failure of the exhibitors to fulfil their engagements. Many leading implement manufacturers who have gained renown and glory at the trials of the Society, who still record with pride in their trade circulars and advertisements their triumphs thus achieved, now decline to enter implements at all for the trials, saying that they consider the day of trials has passed and gone; that perfection has been attained; in short, that the millennium of machinery has been consummated. This is, at least, straightforward; but

to enter for trial and then to withdraw from it is unintelligible, childish, and vexatious.

A Steward of Implements who has served his time, and who has gone through the four years' course, must be struck with the energy, assiduity, and intelligence of the Judges as a rule; and at Taunton, during the recent trials of mowing-machines, it was refreshing to see how hard the three Judges worked. No Judges, moreover, from what class or in what way they might have been selected, could have displayed more impartiality, greater intelligence, or a more thorough practical knowledge; notwithstanding a paragraph in the 'Times' of the 12th of July, which was copied and circulated by a leading firm of implement-makers, who exhibited largely at Taunton, upon the reverse of their trade card. This objected to the prize system, and the Society's Judges were described in it as "three farmers more or less competent to form an opinion, but also liable to unconscious predilection for one principle or one fashion in the mechanism submitted to their judgment or fancy." Now, it is questioned whether any more competent tribunal to judge agricultural machinery could be formed than that composed of practical farmers who understand how to work the machines themselves, and know exactly what is required of them; who have a fair knowledge of mechanical principles, and are assisted and advised by a staff of talented engineers, furnished with improved machinery for testing draught and other vital elements, which are duly taken into account in the decisions and awards. There can hardly be a happier combination of science with practice. The tables of points of merit to be awarded for perfection in the various qualifications of the different machines and implements for trial show how evenly the scientific and the practical are balanced. If those arranged for the late trials of mowing-machines are examined, it will be seen that more than half of the maximum of 1000 points denoting perfection are assigned to qualifications that must in a great degree be gauged by the engineers, and determined with mathematical precision by the dynamometer. The Judges cannot arbitrarily ignore and set aside these results; and it is difficult to understand how their alleged predilection for one principle or one fashion in the mechanism submitted to their judgment can influence or guide them in awarding the more practical points, which are as follows: viz., No. 4, "General arrangement and adaptation of machine for working on uneven ground. No. 6. General perfection of work, including closeness and evenness of cut, freedom from clogging, and mode of leaving the grass. No. 7. Price." These are absolute qualities: no machine combining these could be ignored by the Judges upon a simple question

of principle or fashion. The natural impulse of practical men would be to declare that the quality of the work done demonstrated the principle. Scientific men would be more likely to set up a standard of principle, and say that the work must be levelled up to their ideal; but the Judges, from their training, their habits of thought, their instincts, would not be likely to sacrifice the real, the useful, to any exalted aimings at the æsthetic or the beautiful. Whatever may be thought individually as to the trial system, and as to its continuance or otherwise, it is passing strange that "great firms," who have taken advantage of it, and have hitherto been only too glad to be "ticketed as first, second, and third," by the Judges of the Royal Agricultural Society, should now protest against the system and the manner in which it has been carried out, and issue their protests in the Showyard of the Society under the very shadow of its wings.

The Stewards of Implements always have had considerable trouble with regard to the awards of the ten silver medals which are placed at the disposal of the Judges each year. The exhibitors think that the whole of these medals must necessarily be given away, and that the Council of the Society intend that they should be distributed somewhat in a broadcast fashion among ingenious and novel adaptations. Frequently the Judges themselves do not rightly interpret the "instructions" as to awarding them; and it has happened occasionally that the Stewards have had to exercise their power of withholding their consent to awards made in cases where the spirit of the instructions has been disregarded. Much dissatisfaction was felt at Taunton because of such action on the part of the Stewards, and it was difficult to make the exhibitors understand that these medals are reserved "as a mark of approval of any new principles of construction which the Judges may consider an essential improvement, subject always to the restrictions contained in Rule 2," which is as follows:—"These medals cannot *in any case* be awarded to any implement included in the ordinary rotation, (1) unless it belongs to the classes for which prizes are offered at this Meeting; or (2) the principle on which the implement is constructed be entirely new, and the implement never before exhibited at any of the Society's Shows." It is further provided that "no medal shall in any case be awarded to any implement capable of trial until it has been subjected to such trial as the Stewards may direct." The object which the Society has in offering these medals, with the above-recited conditions, is obviously to bring to the front any new invention or principle of construction in implements without the delay that might be incurred in waiting for the ordinary

rotation; and it is the duty of the Stewards and Judges to see that these objects are fulfilled, and that the Society's medals are not lavished unworthily nor made too cheap.

A programme of the order of the trials to take place at Taunton was arranged and widely circulated early in the trial-week, that all concerned and interested might have some idea as to the day when certain machines would be tried. This programme was adhered to fairly well, and, it is believed, was much appreciated by exhibitors and the public generally. It is most desirable that a similar public notification of the order of the forthcoming trials should always be published as early as possible; also that the Stewards should see that the order is followed as closely as circumstances will allow, as it would materially assist them in their duties, and cause the Judges to work with more method and system.

The vivid recollection of most pleasant labours in connection with the Shows at Cardiff, Hull, Bedford, and Taunton, tinges the parting at the end of the Stewardship with regret, which feeling is intensified as the remembrance of the many courtesies, hospitalities, and kindnesses received from the inhabitants of those towns, from all the other officials of the Society, and from all connected with the Show, comes surging up in the memory.

XXIII.—*Report on the Trials of Implements at Taunton.* By JOHN HEMSLEY, of Shelton, Newark.

IT can scarcely be matter of surprise that competitive trials of agricultural machinery, carried out upon an extensive and public system, should continue to command so much attention from manufacturers and purchasers, when we consider the continued demand there is for machinery having a labour-saving character, especially at this particular time. If these trials were not so conducted, farmers would be compelled to compare machinery in their own hands privately, with much inconvenience and perplexity to themselves; and it is extremely doubtful whether, if this latter plan had been relied upon, this generation would have witnessed anything like the present degree of perfection in agricultural machines.

The Royal Agricultural Society has endeavoured to carry out these trials, at no little cost, in a manner certainly not attempted by any other institution in this country; and whatever may be its future course of action, the farmers of England feel greatly indebted to it for the course it has hitherto pursued in this respect. The strength of a machine, the power to

be saved, and its execution in work, cannot be determined by the eye; red and blue paint and fine gilding, first-class workmanship. and even the persuasions of a clever pushing agent, are not sufficient to induce farmers to approve and adopt, without more convincing proofs of excellence. It is not to be supposed that prize-taking machines are the only ones in favour with the public; but any of those selected machines which get well through these severe tests and examinations may be considered safe ones to buy. In arranging these trials, an institution like the Royal Agricultural Society may be expected to look a little farther into the requirements of the English farmer than individuals might do. A good opportunity is also offered to manufacturers on these occasions for comparison and improvement.

These trials have of late years been watched so intently, and reported upon so ably and, generally, so truthfully by gentlemen of scientific and practical knowledge, in the daily and weekly press, that a report in this Journal, necessarily delayed until a large amount of interest is lost before it reaches the hands of members of the Society, seems somewhat of a repetition of matter patent to the agricultural world; but the official report has the advantage of being prepared with that care which is required in drawing up tables and in noting facts which may be referred to in future, as a kind of record of the present state of agricultural machinery.

The same scissors-like motion, and the same principle of conveying power from the bite of the travelling wheel upon the ground, have been maintained since the first introduction of mowing-machines. Those two important elements, power and speed, have always seemed to be wedded on very fair terms in these machines; but we may well suppose that the simplifying and arranging of all their parts, according to their present mechanical construction, must have required many thousands of experiments, especially when we consider what work is performed by them. The knife runs at a very rapid speed close to an uneven surface, consequently coming into contact with stones, sticks—not unfrequently with pieces of iron brought in manure—mole- and ant-hills, often of a consistency like glue; at other times driving through the uneven surface as hard as a road, or running full speed into deep unseen furrows.

The comparison of these machines is therefore very different from that of barn machinery, or even of corn-mowing machines. Superior material and construction are of the utmost importance, and fairly claim one-half of the points of merit; but it may be doubted by many whether it is not more easy to compare construction and material in prize-taking machines, than it is with commercial ones. Upon this point the Society, in the printed

form of general regulations, under the heading of "Entries for trial," issued the following notice:—

The specification must state the selling-price of each article *complete* and in good working-order; and each exhibitor will be bound to execute all orders given to him in the Showyard at the price stated in this specification, and to deliver the Implements within six months of the close of the Show, on pain, in case of failure in such engagement, of not being again allowed to exhibit at the Meetings of the Society.

In order to ensure a *bonâ fide* selling-price being specified for competing machinery it shall be a condition that, if the price certified by the exhibitors shall, in the opinion of the Engineer-Judge, or Judges, together with the Consulting Engineer of the Society, be stated so manifestly low that the exhibitor cannot consistently supply at such price, the Judges shall have power to decline to try such machinery.

It may also be doubted whether, although one machine may be superior to another in these short trials, it would continue to be so after a certain amount of work; but it should be remembered that the best means of estimating this is the thorough examination which these machines undergo by the very able engineers to the Society; and that in the best of them the parts are so constructed and arranged as to produce the least possible amount of friction; and this important quality has not been by any means lost sight of by the Judges in awarding the points of merit.

I wish to take this opportunity of stating that the English farmer is much indebted to the American inventors of these machines, as well as to the present manufacturers, for their enterprise in competing in such a spirited manner in this country, the results from which may not at first sight be adequately estimated.

The history of the trials of grass-mowers by the Royal Agricultural Society is to be found in the volumes of this Journal for the years 1857 (when prizes were first offered for them *), 1861, 1865, and 1869. The interest of the farmer in these truly labour-saving machines may not be considered so great now as it was at the Manchester trials, when the conclusion was arrived at that he might safely invest in any one of the best of them; but it remained for the present year's trials by the Society to exhibit their perfection in such a high degree: strength given without adding unnecessary weight, improvement in wearing parts, and the machines altogether better adapted for heavy and difficult cutting; in fact, the large majority of the machines which were brought to trial at Taunton will be found much cheaper machines than those which competed in 1869. It was obvious that a smaller number of what comparatively might be termed inferior machines came to trial at Taunton than at Manchester.

Taking the usual calculations for horse-power, interest of

* These were carried off by American inventions.

capital, and charging a fair allowance for wear and renewal, it would seem that a farmer having 20 acres of cutting would be justified in buying a machine: thus—interest, 1*s.* per acre; renewal, 9*d.*; repairs, oil, &c., 1*s.* 3*d.*; 4 horses, 1 man, 1 boy, in small fields, to cut 10 acres per day, 1*s.* 9*d.* per acre = 4*s.* 9*d.* per acre; upon a larger scale with larger fields this item would be considerably less. At this season of the year, also, horses are not always in so much request upon the farm, and in such cases the actual costs would be much reduced. Expedition, again, in this treacherous climate, is a great object; and the cut grass is left in a much better state for drying when cut by machine than when mown by the scythe.

On Saturday, July 3rd, the Stewards carefully examined the different fields, and arranged the measuring of them. Four of them were set out in 60 perches each for the first trials of two-horse mowers; they were old turf-land not generally mown, the bottom being dead and soft. The plots had open grips or drains running across them; and the crop was estimated at from 40 to 50 cwts. of hay per acre. The plots were tolerably uniform in point of difficulty, some having more ant-hills on them than others, but certainly nothing to prevent practical judges making a fair comparison, allowances being made for any such variations. In two other fields, the crop was clover and trefoil, estimated at from 45 to 50 cwts. per acre, very long and much laid; these were set out for the second trials of two-horse mowers; and a piece of difficult work, in another field, was reserved for their final trial. Two remaining fields of meadow-land, regularly mown, and much lighter in crop, from 20 to 30 cwts. per acre, were reserved for the one-horse machines; and in these two fields much time was spent in selecting suitable plots as level and uniform, and as free from ant-hills as possible, for the dynamometer tests of all the machines. These arrangements proved to meet the requirements of the Judges; and no alteration was made, except in one field, where a small strip of rough land covered with stones, and quite impracticable, was by an oversight measured with four or five plots of grass, which the Judges at once objected to.

It may be remarked that, by these preparations, the Judges were enabled to concentrate their undivided attention upon their onerous duties.

The situation of the trial-fields was most conveniently secured by the Local Committee, who, in all their arrangements, had well studied the success of the Meeting.

The whole of the machines for trial were arranged inside the Showyard for greater safety on Saturday evening. The only exhibitors, whose machines were entered for trial, who did not put in an appearance, being the Johnstone Harvester Company,

iose machine met with an accident in transit, and Mr. Bamlett's ur machines, which were withdrawn. It was unfortunate that e public had not an opportunity of witnessing these well-known d excellent machines tried, and tested for draught, but the cuse which this gentleman made for not bringing them to trial is still more unfortunate.

The trials were watched throughout by a large number of in-rested persons; indeed, one of the most pleasing features of the aunton Meeting was the general agricultural character of the great ajority of the spectators during the whole time of the exhibition.

The Society was fortunate in securing the services of the ree following experienced gentlemen as Judges in the Mowing-achine Classes:—Colonel Grantham, West Keal Hall, Spilsby; hn Hicken, Dunchurch, Rugby; James W. Kimber, Fyfield-ick, Abingdon. The following instructions, previously pub-shed in the Prize-sheet, were handed to them:—

Instructions to the Judges.

1. The Judges will have from 9 o'clock in the morning of Monday, the 5th ily, until noon on Saturday, the 10th July, allowed them for making their judications, and signing their awards, with the exception of any Classes for hich special arrangements may be made.

2. If they should not award the amount of money offered as Prizes in any ass, they will be instructed not to appropriate that sum to any other de-ription of Implement.

3. The Judges will be instructed to deliver to the Stewards their *final* and *mplete* awards of Prizes and Medals immediately their decisions are completed.

4. The Judges will be requested to observe that it is left to their discretion select the Implements for trial from those *specially entered* for competition r the Society's Prizes, as well as, if they consider it desirable, from those not entered.

5. The Judges will decide on the merits of the work done by any Agricul-ıral Machines to which steam or other power is applied; but they will be quired to pay every attention to the report of the Consulting Engineer as to e power used, the mechanical construction of the Machine, and the quality f workmanship and materials used.

6. The Judges will be instructed to pay particular attention to the con-itions relating to the qualifications each Machine should possess, and to the peed and pressure as given.

7. The Judges will be instructed that in the trial of Machines, in every ase where practicable, steam-power should be adopted instead of horses, as he most accurate test of the relative working of Machinery.

Points of Merit to be awarded for Perfection in various Qualifications.

Classes I. and II.—For the best One or Two-horse Mowing Machine.

1. Mechanical construction and workmanship, with soundness and quality of materials	250
2. Simplicity and lightness, combined with strength	100
3. Arrangement of gearing-crank and its connections; construction of knife and bar, with form and position of fingers ..	100
Carried forward	450

Brought forward	450
4. General arrangement and adaptation of machine for working on uneven ground	100
5. Lightness of draught in and out of work	150
6. General perfection of work, including closeness and evenness of cut, freedom from clogging, and mode of leaving the cut grass	250
7. Price	50
	1000

Class I.—One-horse Mowing Machines.

The Judges at the last trial of grass-mowers by the Royal Agricultural Society, at Manchester, dealt with a high hand with these machines, and summarily dismissed the whole without even testing them on the dynamometer, on account of excessive draught, expressing themselves in danger of the interference of that notable Society which so fearlessly protects dumb animals.

The Royal Agricultural Society, however, once more in the interest of the smaller class of farmers, determined to offer prizes for them; but the Council took the wise precaution of limiting the draught to the usual standard of one horse-power, and it was somewhat surprising that this caution had not more effect with the exhibitors.

The prizes offered were—

	£
For the best One-horse Mowing Machine	20
For the second best	10
For the third best	5

(The power for one-horse machines not to exceed 33,000 foot-pounds per minute.)

On Monday, July 5th, 14 one-horse machines, by 13 makers, were tried on the dynamometer in a light crop of meadow grass, at $1\frac{1}{16}$-inch cut running through uncut grass on both sides. The names of the exhibitors and the number of the machines will be seen in Table I., annexed. This first trial was not satisfactory, as it was found that the frame-wheels of the new dynamometer were too wide when these machines were attached to it by the shafts provided by the manufacturers, and consequently a part of the grass that should have been cut was pressed down by the dynamometer wheels.

Two special conditions had been drawn up by the Society, and previously circulated amongst the Exhibitors as follows:—

Conditions of Trial.

1. Such implements as the Judges may direct will be tested for draught by means of the new horse-dynamometer which was used in the cart and waggon

Table I.—Summary of Results of Trials of One-Horse Mowing Machines (Class I.).

(The power of one-horse machines not to exceed 33,000 foot-lbs. per minute.)

There were 18 Entries in this Class, and 14 of these were presented for Trial.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
				Construction.				Dynamometer Trials. Trial I., in a moderate crop of Meadow Grass. The Machines were run through Grass not mown on either side.			
Name of Exhibitor.	Catalogue Number.	Order of Trial.	Price.	Width for Cutting.	Length of Finger Points.	Distance between Centres of Fingers.	Right or Left Handed.	Height of Knives for Cutting.	Mean Draught in lbs.	Mean Speed in Miles per Hour.	Foot-lbs. of Work per Minute, assuming Mean Speed of 2½ Miles per Hour.
			£ s.	' "	"	"		"			
Samuelson and Co.	182	2	18 10	3 3	3½	3	Right	1 1/16	185·9	..	40,898
Williams, John	508	4	18 10	3 1½	4½	2¾	Right	1 1/16	210·0	3·72	46,200
Brenton, W.	2625	5	17 0	3 2½	4½	3	Left	1 1/16	227·9	3·52	50,138
Wray, John	198	6	18 0	3 3	4½	3	Left	1 13/16	350·5	2·9	77,110
Pickaley, Sims, and Co. ..	2414	8	18 0	3 3	4½	3	Left	1 1/16	268·0	3·6	58,960
Haughton and Thompson ..	2771	10	19 10	3 6	5½	3	Right	1 1/16 †	289·7	3·42	63,734
Wood, Walter A.	2436	11	19 10	3 6	4¼	3	Right	?	193·	3·51	42,460
Brigham and Co.	1177	12	17 10	3 6	4¾	3	Right	1 1/16	296·3	2·4	65,186
Wood, William Anson	192	13	20 0	3 6	4½	3	Right	1¼ *	208·6	3·48	45,892
Fell, W. A.	76	14	19 0	3 1	4¼	2½	Right	1 1/16	210·6	..	46,332
Harrison and M'Gregor ..	738	15	18 0	3 2½	4¼	3	Left	1 1/16	227·5	2·8	50,050
Hornsby and Sons	578	16	17 10	2 9	3¾	3	Right	1 1/16	150·5	2·63	33,110
Kearsley, H. and G.	564	17	19 0	3 6	4½	3	Right	1 1/16	254·1	3·0	55,902
Hornsby and Sons	579	18	18 0	3 0	3¾	2½	Right	1 1/16	184·9	2·74	40,678

1.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
	Trial II., on light crop of Meadow Grass. Machines run through Grass.				Trial IV., on Light Crop of Meadow Grass. Height of cut and speed of Horses left to the several Exhibitors to arrange. Six Machines selected by the Judges after Trial III. Machines run through Grass as in Trial I.						
Name of Exhibitor.	Height of Knives for Cutting.	Mean Draught in lbs.	Mean Speed in Miles per Hour.	Foot-lbs. of Work per Minute, assuming Mean Speed of 2½ Miles per Hour.	Height of Knives.	Actual Width of Cut.	Speed in Miles per Hour.	Draught in lbs.	Foot-lbs. of Work per Minute, at actual Speed.	Foot-lbs. of Work per Minute, assuming Mean Speed of 2½ Miles per Hour.	Draught in lbs. per Inch, Width of effective Cut.
	"				"	' "					
Samuelson and Co.	1¼	152 1	3·27	33,462	1¼	3 3	2·81	194·4	48,016	12,768	4·98
Williams, John	1¾	186·3	3·30	40,986							
Brenton, W.	1¼	197·5	3·22	43,450							
Wray, John	..										
Pickaley, Sims, and Co.	1¼	210·0	3·32	48,180							
Haughton and Thompson	..										
Wood, Walter A.	1¾	168·1	3·36	36,982	1¼	3 5½	2·26	173·6	34,516	38,192	4·20
Brigham and Co.	1¾	212·8	2·90	46,816							
Wood, William Anson	1¾	173·2	3·34	38,104	1 3/16	3 4	2·35	179·3	37,115	39,446	4·48
Fell, W. A.	1 11/16	160·9	3·12	35,398	..	..	..	..	..	..	..
Harrison and M'Gregor	1¾	178·3	3·29	39,226	1⅜	3 2	2·3	189·4	38,259	41,668	4·98
Hornsby and Sons (578)	1¾	123·0	3·33	27,060	1¾	2 8½	2·28	148·8	29,909	32,736	4·57
Kearsley, H. and G.	1¾	210·2	2·86	46,244							
Hornsby and Sons (579)	1¾	134·5	3·29	29,590	1 3/16	2 11	2·34	166·2	34,237	36,564	4·74

1.	24.	25.	26.	27.	28.	29.	30.	31.	32.	33.	34.	35.	36.
	Trial V., on light Crop of Meadow Grass. Each Machine set at 1¼ inch high, and cutting as wide as practicable, with Machine itself running on margin already cut as in ordinary work.									Trial III., of seven Machines selected after Trial II., on Meadow Grass, for excellence of Work, July 8. Crop Light.			Trial VI. Final Trial of six selected Machines.
Name of Exhibitor.	Height of Centres of Knives and Points of Fingers.	Actual Width of Cut.	Speed in Miles per Hour.	Draught in lbs.	Foot-lbs. of Work per Minute, at actual Speed.	Foot-lbs. of Work per Minute, assuming Mean Speed of 2½ Miles per Hour.	Draught in lbs. per Inch, Width of effective Cut.	Foot-lbs. of Work per lb. of Hay made, assuming it to equal 1½ Ton per Acre.	Draught of Machines empty, but Knives working.	Speed in Miles per Hour.	Width of Cut.	Acreage cut per Hour, assuming Mean Speed of 2½ Miles per Hour.	
		' "									' "		
Samuelson and Co.	Knives 1½, Points 1 3/16	3 2½	3·23	201·8	57,513	14,396	5·24	841	87·5	1·6	2 10½	·87*	The six machines marked thus * were finally tried for excellence of work on July 11.
Williams, John													
Brenton, W.													
Wray, John													
Pickaley, Sims, and Co.													
Haughton and Thompson													
Wood, Walter A.	Knives 1½, Points 1 5/16	3 1¼	3·20	169·6	18,000	37,312	4·16	644	70·2	3·2	3 4	1·01*	
Brigham and Co.													
Wood, William Anson	Knives 1⅓, Points 1 11/16	3 5¾	2·86	176·3	41,604	38,786	4·22	652	80·7	4·3	3 1¾	·95*	
Fell, W. A.	..	..	..	..	..	..	..	..	..	..	2 10¾	·88	
Harrison and M'Gregor	Knives 1⅓, Points 1¼	3 2	2·56	189·0	42,714	41,580	4·97	768	76·0	4·7	2 9¾	·85*	
Hornsby and Sons (578)	Knives 1¼, Points 1 7/16	2 9	2·76	133·5	32,550	29,370	4·04	625	45·9	4·2	2 7	·78*	
Kearsley, H. and G.													
Hornsby and Sons (579)	Knives 1½, Points 1¼	2 11¼	2·91	161·8	41,583	35,596	4·57	707	70·4	5·0	2 9¾	·85*	

Points of Merit Awarded by Judges.

Name of Exhibitor.	Catalogue Number.	Mechanical Construction and Workmanship, with Soundness and Quality of Materials.	Simplicity and Lightness, combined with Strength.	Arrangement of Gearing, Crank, and its connection; Construction of Knife and Bar, with Form and Position of Fingers.	General Arrangement and Adaptation of Machine for working on uneven Ground.	Lightness of Draught in and out of Work.	General Perfection of Work, including Closeness and Evenness of Cut, Freedom from Clogging, and Mode of leaving the Cut Grass.	Price.	Totals.	Remarks and Awards.
		Perfection being.								
		250.	100.	100.	100.	150.	250.	50.	1000.	
Samuelson and Co.	182	210	90	65	70	..	170	40	645	Disqualified for excessive power.
Wood, Walter A.	2436	150	85	50	65	..	170	32	552	Ditto ditto.
Wood, W. Anson	192	125	80	35	65	..	130	30	465	Ditto ditto.
Harrison and M'Gregor ..	738	170	75	60	70	..	230	35	640	Ditto ditto.
Hornsby and Sons	578	250	90	90	100	150	240	48	968	First Prize.
Hornsby and Sons	579	250	80	90	100	..	250	47	817	Disqualified for excessive power.

To face page 634.

* Mean.

† Cut ½ inch higher than others.

TABLE III.—SUMMARY OF RESULTS OF TRIALS OF HAYMAKING MACHINES (CLASS III.).

There were 14 Entries in this Class, and they all came up for Trial.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
											POINTS OF MERIT.						
NAME OF EXHIBITOR.	Catalogue Number.	Order of Trial.	Price.	Diameter of Wheels.	Distance between Centre of Wheels.	Effective Width for Tossing.	Number of Forks.	Length of Forks.	Height of Teeth above Ground during Trial.	REMARKS.	Mechanical Construction and Workmanship, with Soundness and Quality of Material.	General Arrangement of Machine and its Gearing, including Forward and Back Motion, Simplicity and Lightness combined with Strength.	Arrangement and Adaptation of Machine for Working on Uneven Ground.	Perfection of Work done on Trial, including Freedom from Clogging and Ease of Management.	Price.	Totals.	AWARDS.
											PERFECTION BEING						
											300.	200.	150.	300.	50.	1000.	
			£ s	ft. in.	ft. in.	ft. in.		in.	in.								
Nicholson and Son	1026	1	11 0	4 0	6 2½	5 1	60	7	..	.. ..	150	120	0	180	35	485	
Nicholson and Son	1024	2	16 10	4 0	..	6 6	60	7	..	.. ..	150	140	0	190	35	515	Commended.
Boby, Robert	934	3	16 0	3 11	7 0¼	5 4	50	6¾	..	.. ..	140	140	0	150	30	460	
Reading Iron Works	426	4	16 16	4 0	6 10	5 2	60	8	..	.. ..	140	150	0	200	35	525	Third Prize.
Affleck, William	2653	5	14 5	3 8	7 1¾	5 6	57	6	1	Springs to hold teeth in position, fixed to wooden bar. There are two sliding pinions at each end of machine ..	100	110	0	90	25	325	
Nicholson and Son	1025	6	16 16	3 10	6 5¼	5 3 forward; 5 8 backward	72	6	1	Reversed by inside and outside pinion; speed forward 5 to 1, back 7 to 1; pinion 1½" wide, 4½" diameter..	150	130	0	175	35	490	
Nicholson and Son	1029	7	14 14	..	..	..	..	..	..	.. ..	150	130	0	140	35	455	
Beare, Son, and Co.	3294	8	13 13	3 8	5 9	4 11¾	48	5¾	1	.. ..	100	110	30	80	30	350	
Reading Iron Works ..	427	9	15 15	3 8	7 1½	5 6	60	8	..	Driving pinion 15" diameter	140	150	0	190	35	515	Commended.
Boby, Robert	935	10	14 0	3 11	7 0¼	5 4	50	6¾	..	Machine too light for crop	140	130	0	50	30	350	
Ashby, Jeffery, and Luke	201	12	15 15	4 0	7 6	6 0	84	8	1	Back motion slower than forward	260	170	0	260	40	730	First Prize.
Ashby, Jeffery, and Luke	202	14	14 14	3 10	6 8	4 8	72	7½	1	.. ..	240	160	0	220	35	655	Second Prize.
Nicholson and Son	1030	11	17 10	4 0	6 7½	5 1 forward; 5 7 backward	72	7	1½	Wheels 5 to 7 for slow motion .. .. „ 6 to 9 for quick motion	150	120	0	180	35	485	
Nicholson and Son	1027	13	15 0	4 0	6 2½	5 0 forward; 5 6 backward	72	7	..	.. ..	150	130	0	150	35	465	

To face page 635.

rials at Bedford, and which is fully described in the last number of the Society's 'Journal,' second series, vol. x. pages 679–682.

2. For this purpose all mowing machines must be provided with one pair of shafts, into which the dynamometer can be yoked by means of its harness, which represents ordinary cart harness. A mowing machine under trial for draught must be drawn by means of that pair of shafts alone.

And although clause 1 points out the machine that was to be used, and where a full description of it was to be found, not one of the exhibitors arranged their shafts so as to make the wheel-track clear off the knife-bar.

This oversight was rectified in all the succeeding dynamometer trials by an alteration in attaching the machines, so that the carriage wheels could clear the track of the cutter-bar.

This trial, however, proved that all the machines, with one exception, were above the restricted draught. The engineers and Judges decided to try them again at a cut of $1\frac{3}{4}$ inch in a lighter crop. Two were withdrawn, and a similar result was produced, as will also be seen by Table I.

It was then thought desirable to make a selection to be tried for quality of work, and seven which drew less than 40,000 foot-pounds* were tried on July 8th, and the following notice was posted up:—

Notice to the Exhibitors of the seven One-horse Mowers selected for further trial, viz.:

	Cat. Number.
Samuelson and Co.	182
Walter A. Wood	2436
W. Anson Wood	192
W. A. Fell	76
Harrison and M'Gregor	738
Hornsby and Sons	578
Ditto	579

These machines will be tried first for quality of work, in No. 9 Field, this morning.

Those selected will then be subjected to trial for power by dynamometer, under the same conditions of cut as in the trial for quality.

Exhibitors will be allowed to drive the horses of the Society in the Dynametrical Trial at such speed as they choose, note of which speed will be taken by the Judges.

The competitors are hereby cautioned that, from the preliminary runs on the dynamometer, it is evident that these machines are all in danger of being disqualified for the Prizes on the score of power.

(Signed) CHARLES WHITEHEAD, JABEZ TURNER, JOHN HEMSLEY, } *Stewards of Implements.*

Stewards' Office, July 8th, 1875.

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* A plain explanation of the term "foot-pounds" will be found at p. 414 in vol. viii., second series of this Journal.

After these seven were tried for quality of work at a heigh of cut varying from $1\frac{1}{8}$ to $1\frac{5}{8}$ inch, No. 76 was dismissed by th Judges, and the remaining six were put to the dynamometer Table I. (facing p. 634) will show the result.

On Monday, the 12th July, after the two-horse machines ha been disposed of, these six were once more tried in a light cro of meadow grass very little over 20 cwts. per acre; they were al set in the same manner as the two-horse machines, at a cut o $1\frac{1}{2}$ inch, with an open side of grass cut, and put to the dyna mometer; the result of this trial is also shown in the Table.

It may here be remarked that the Judges could not entertai any question what power was required to cut 1 inch or 1 foo of grass; here was a machine intended to be drawn by one hors taking its full width of cut; was that machine within the limite power, or was it not? and upon this point the Judges had n discretion but to disqualify all, with the exception of No. 57 having a width of cut of 2 feet 9 inches.

Award.

First Prize of 20*l.*, to Messrs. Hornsby and Sons, of Grantham (578), f their One-horse Mowing Machine.

All other machines in this Class disqualified from being overdraught.

Some erroneous figures as to the draughts of these machin having been published in some of the newspapers, the followin statements from the engineers' notes was posted up in the Sho yard, with a view to prevent further wrong impressions.

Class I.—One-horse Mowing Machines.

Exhibitor's Name.	Catalogue Number.	Draught in lbs. when Working.				Draug whe Unload in Final Tr
		First Trial. Set at $1\frac{1}{16}''$.	Second Trial. Set at $1\frac{3}{4}''$.	Third Trial.	Fourth Trial. Set at $1\frac{1}{2}''$.	
Samuelson	182	185·9	152·1	194·4	201·8	87·
Walter A. Wood ..	2436	193·	168·1	173·6	169·6	70·
W. Anson Wood ..	192	208·6	173·2	179·3	176·3	80·
Harrison & M'Gregor	738	227·5	178·3	189·4	189·	76·
Hornsby	578	150·5	123·0	148·8	133·5	45·
Hornsby	579	184·9	134·5	166·2	161·8	70·

Class II.—Two-horse Mowing Machines.

The prizes offered in this Class were—

	£
For the best Two-horse Mowing Machine	30
For the second best	20
For the third best	10

Table II.—Summary of Results of Trials of Twenty selected Two-Horse Mowing Machines (Class II.).

There were 41 Entries for Trial in this Class. Of these, 35 Implements were presented and were Tried on Meadow Grass. The 20 Machines enumerated below were then selected from them after first Trial.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	32.	33.	34.
				Weight on Wheels, with Knife-bar Lifted, in cwts., qrs., and lbs. Exclusive of Driver.			Construction.					Trial I., on Plots of about ½ of an Acre of Meadow Grass, a heavy Crop.				Trial III., on Dynamometer in Meadow Grass. All Machines set at 1½ Inch high, and run through Grass not mown on [illegible] side. A narrow strip of uncut Grass left between [illegible] and Cut.									Points of Merit Awarded.								
Name of Exhibitor.	Catalogue Number.	Order of Trial.	Price.	On Knife Wheel.	On other Wheel.	Total.	Width.	Length of Finger Points.	Distance between Centres of Fingers.	Right or Left Handed.	Specialities of Construction.	Effective Width cut.	Speed in Miles per Hour.	Area in Acres mown per Hour at assumed Speed of 3 Miles per Hour, allowing for Stoppages, Width = 73	Trial II., on a Heavy Crop of Clover in Field 2, the Weather being Wet.	Effective Width.	Speed in Miles per Hour.	Draught in lbs. when Working.	Draught in lbs. when Running Light.	Foot-lbs. of Work per Minute at actual Speed	Foot-lbs. of Work per Minute at assumed Speed of 3 Miles per Hour.	Side Draught at 24 Inches back from Front of Pole in lbs.	Draught in lbs. per inch of Width of effective Cut.	Foot-lbs. of Work done per lb. of Hay finally made, assuming that to equal 2 Tons per Acre.	Mechanical Construction and Workmanship, with Soundness and Quality of Materials.	Simplicity and Lightness, combined with Strength.	Arrangement of Gearing, Crank, and its connections, Construction of Knife and Bar, with Form and Position of Fingers.	General Arrangement and adaptation of Machine for Working on uneven Ground.	Lightness of Draught in and out of Work.	General Perfection of Work, including Closeness and Evenness of Cut, Freedom from Clogging, and Mode of leaving the Cut Grass.	Price.	Totals.	Awards.
																									Perfection being								
																									250.	100.	100.	100.	150.	250.	50.	1000.	
			£ s.	cwt. qrs. lbs.	cwt. qrs. lbs.	cwt. qrs. lbs.	' "	"	"			' "				' "																	
Samuelson and Co.	181	7	21 0	3 0 22	2 2 8	5 3 2	4 2	4	3	Left ..	Ingenious arrangement of Draught Chains over Pulleys to prevent excessive pressure of Knife-bar on ground, and so reduce Draught.	..	The speeds of only nine machines in these trials were recorded. The slowest was 3·38 miles per hour, and the average with the nine machines was 3·61 miles per hour.	..	The twenty machines included in this Table were selected from the thirty-five machines which were submitted to the First Trial, and were tried on the 9th July on a heavy crop of Clover in Field 2, where the Judges were enabled to make some valuable observations on the working of the machines.	4 1	2·36	191·2	81·1	39,561	50,212	18	3·88	450·	220	90	90	70	150	230	38	888	Highly Commended.
Hornsby and Sons	583	36	20 0	3 0 20	2 3 10	6 0 2	4 3	4	3	Right	Cast-iron frame and long connecting-rod.	3 10¼		1·41		4 3	2·47	213·3	89·1	46,456	56,311	25½	4·18	484·	240	97	90	80	130	200	45	882	Highly Commended.
Burgess and Key	2824	32	20 0	4 3 25	1 2 21	6 2 18	4 2¼	4½	3	Right	Three speeds for Knife-bar, short connecting-rod, steel Crank-shaft, and bushes. Draught arrangements special.	3 11¼		1·44		4 1¾	2·61	230·4	110·7	53,081	60,825	28	4·62	536·	200	85	50	60	121	190	36	712	Commended.
Harrison and M'Gregor ..	741	8	21 0	4 0 2	3 0 12	7 0 11	4 2¼	4½	3	Left ..	.. ..	3 10¾		1·42		4 2½	2·67	237·6	111·7	56,026	62,726	22½	4·67	511·	160	72	60	50	120	215	33	720	Commended.
Picksley, Sims, and Co. ..	2446	34	21 0	3 3 27	3 0 20	7 0 19	4 2¼	4½	3	Left ..	.. ..	3 11½		1·44		4 3	2·60	268·4	116·5	61,678	70,858	30	5·26	610·	180	78	50	60	105	180	31	684	
Hornsby and Sons	582	33	20 0	3 1 26	2 2 15	6 0 13	4 3¼	4	2 9/16	Right	.. ..	3 10¾		1·41		4 3¼	2·75	223·4	74·2	51,286	58,977	25	4·32	501·	250	100	100	100	125	205	50	930	Second Prize.
Wood, Walter A.	2137	29	21 0	3 1 22	2 0 15	5 2 9	4 2¼	4	3	Right	.. ..	3 11¼		1·43		4 3¼	2·70	235·4	103·9	56,025	62,115	25½	4·58	531·	150	80	50	40	121	220	29	690	Commended.
Samuelson and Co. . ..	183	24	21 0	3 0 27	2 11 0	5 1 27	4 2¼	4	3	Right	Same remarks as for 181	3 9¼		1·37		4 1½	2·75	212·0	78·3	51,516	55,968	27	4·31	500·	220	80	90	70	130	225	35	850	Highly Commended.
Hornsby and Sons	580	11	20 0	3 1 20	2 2 20	6 0 12	4 3	4½	3	Right	Short connecting-rod. Knife-bar can circle round Crank-shaft centre. Pole adjustable sideways.	3 10¼		1·41		4 3¼	2·62	226·6	81·0	52,480	59,822	25	4·37	507·	250	100	100	100	123	215	50	938	First Prize.
Hornsby and Sons	581	38	20 0	3 0 11	2 0 25	5 1 9	4 3	4	3	..	Ditto ditto	3 10¼		1·41		4 3½	2·61	217·6	68·3	50,135	57,416	25½	4·25	493·	250	82	100	100	110	200	48	920	Third Prize.
Harrison and M'Gregor ..	742	21	21 0	3 3 27	3 0 20	7 0 19	4 2½	4½	3	Left ..	.. ..	3 11½		1·44		4 2	2·68	216·8	102·6	58,313	65,155	16	4·93	572·	160	72	50	60	118	195	32	687	
Picksley, Sims, and Co. ..	2445	18	19 0	3 3 0	2 2 19	6 1 19	4 3	4½	3	Right	.. ..	3 9¼		1·38		4 2	2·58	229·1	96·1	52,234	60,482	23½	4·58	531·	180	84	40	60	124	150	32	670	
Kearsley, R. and G.	565	13	20 5	3 3 15	2 3 26	6 3 13	4 2¼	4½	3	Left ..	Wrought-iron Rocking Frame ..	4 1		1·48		4 3	2·68	271·0	111·6	64,064	71,514	24½	5·34	616·	150	70	70	40	106	150	30	616	
Harrison and M'Gregor ..	743	3	20 10	3 2 13	3 1 12	6 3 25	4 3	4½	3	Right	.. ..	3 8¼		1·34		4 2	2·76	236·3	101·2	57,704	62,383	20½	4·72	547·	160	72	50	60	122	180	32	676	
Vipan and Headley	700	15	20 0	5 3 0	2 3 16	8 2 16	4 5¼	4¾	3	..	.. ..	4 2¾		1·54		4 4	3·25	339·3	229·5	97,311	89,575	27½	6·52	756·	125	50	90	90	85	160	32	632	
Wood, William Anson ..	193	16	22 0	3 0 20	2 0 1	5 0 21	4 2¾	4½	3	Right	.. ..	3 9¾		1·39		4 2	3·26	206·1	123·8	59,356	51,410	27	4·12	478·	120	74	50	40	134	110	26	554	
Williams, John	510	10	20 10	4 0 2	2 2 17	5 2 19	4 4	4¾	2⅞	Right	.. ..	3 11¼		1·44		4 3	3·01	245·0	141·4	65,856	64,680	36½	4·80	556·	120	70	40	50	110	150	25	565	
Fell, W. A.	78	25	20 0	4 2 4	2 3 2	7 1 6	4 1	4¼	2½	Right	.. ..	3 10¼		1·41		4 1	2·78	236·5	101·5	58,479	62,436	39½	4·82	559·	150	68	40	80	113	140	30	621	
Brenton, W.	2627	28	20 0	3 0 23	3 3 14	7 0 9	4 3	5	3	Left ..	Long connecting Rod. Points adjustable when in motion.	3 11		1·40		4 2	2·80	256·5	131·7	63,406	67,716	32½	5·12	594·	100	60	..	50	108	180	19	517	
Lewis and Lowcock	2217	30	20 0	3 2 0	2 2 9	6 0 2	4 3	4¾	3	Right	.. ..	3 8¼		1·35		4 2	2·68	250·6	120·8	59,392	66,158	25	5·00	580·	100	50	40	60	113	170	25	578	

To face page 637.

Monday, the 5th July, and two following days, were occupied in trying the 35 two-horse mowers in the fields above named, their positions having been assigned by ballot—Hornsby and Sons sent 4; Kearsley, 4; Lewis and Locock, 3; Harrison and M'Gregor, 3; Osborne and Co., 2; Samuelson, 2; Fell, 2; Williams, 2; Brigham, 2; Picksley, Sims and Co., 2; Brenton, 2; Burgess and Key, 1; Vipan and Headley, 1; William Anson Wood, 1; Wray, 1; Walter A. Wood, 1; Matteson, 1; Haughton and Thompson, 1.

The Judges considered that none of them could be disqualified as being duplicates, in the meaning of the term adopted by the Society; and this opinion was confirmed by the engineers, who had all the machines brought back into the Showyard and carefully inspected, accompanied by one of the Judges, but without any attendant from the maker. After the Judges had compared their notes and points, and considered the engineers' report, they selected 20 machines, which are noted in the annexed Table (II.), out of the 35, for further trial on the clover crop on the following day. Heavy rain during the night and forenoon caused this long stuff to be very difficult to quit the machine. Most of the crop laid one way, away from the knife, which, of course, throated it the other: however, all the machines got through very creditably; some of them not cutting quite so low as others, on account of stones they had to encounter. On Saturday these 20 first-selected machines were taken to a plot of light grass, having probably 20 to 25 cwts. of hay per acre. A flat board was placed on the ground, and each machine was put upon it, and the knives were all set at 1½-inch cut from the board, the height which the Judges thought most practical, and which was carefully measured by the assistant-engineer. The machines were then attached to the Society's new dynamometer, and the draught and side-strain were taken, each machine being run round on both sides of the plot (two observations being taken), to ensure uniformity of cut and weight of crop, the average of the two being noted. It may be as well to state that the side-strain was taken two feet, in all cases, from the ordinary attachment at the end of the pole, to suit the draught of the dynamometer. It will be noticed that this side-strain was not taken at the extreme point of attachment to the horse's collar; but all the machines were tried alike. The height of the pole from the ground was regulated at the wish of the exhibitor; but in this point there were very slight differences between them. Each of the machines, before being detached from the dynamometer, was taken to the same solid piece of ground and run in gear, but not cutting, to test the draught for friction only.

These tests occupied a considerable time; and the Judges,

having gone carefully through their points, observations, and notes, which the three previous trials had given them an opportunity of making, expressed themselves satisfied. But, at the request of the Stewards, they selected 10 machines, to give them what they termed a gallop through a difficult piece of work in one of the fields, asking the exhibitors for no restrictions whatever; and although the official trials were concluded to the satisfaction of the Judges, they paid particular attention to the manner in which the work was performed. Nothing, however was noted by them to alter their previous impressions; but they preferred to give in their awards for Classes I. and II. simultaneously.

These 10 machines were Samuelson, No. 181; Harrison and M'Gregor, 741; Hornsby and Son, 580; W. Anson Wood, 193; Samuelson, 183; Walter A. Wood, 2437; Burgess and Key, 2824; Hornsby, 582; Hornsby, 583; Hornsby, 581.

It may here be stated that each of the three Judges took notes separately in the field, and afterwards compared them, and they thus arrived at the conclusions upon which their awards were based; also:—"They wish to state that the engineers pointed out to them, in the most careful manner, the weak and strong points, advantages and disadvantages, of different gearings, and other important points in each machine, and that all these matters were carefully considered, jointly, nothing being determined in an off-hand manner. The system of judging by points keeps their attention to every particular, nothing is left to memory, ample printed log-sheets being provided for each machine in every trial."

The Judges have also drawn up the following Report:—

Two-horse Mowers.

We can speak in praise of the two-horse mowers as a class. The gap between the best and worst machines has lessened considerably since the Manchester Meeting. All the machines tried at Taunton, with one or two exceptions, cut a heavy crop of grass fairly. It must be a satisfaction to the public, as it is to us, to know that this useful and necessary implement has attained to so high a standard of proficiency.

During the whole of the severe trials which the class had to undergo, only two out of the thirty-five machines became "hors de combat." And these two instances of severe breakages were probably owing, in some degree, to the haste and unskilfulness of the drivers. "Lightness with strength," appears to be the motto acted upon in designing a mower; and, as an illustration of the mechanical skill which is brought to bear in this direction, we may mention Hornsby's light "Paragon," which in the final trial fell on a plot with more than the average number of old ant-hills. The powerful horses drawing it were several times brought to a stop (and, on one occasion, the driver pitched off) in so abrupt a manner as to force on one's mind the idea that some part of it must be broken. On examination afterwards, however, the

machine was found to show no evidence of strain or breakage. But we think, in the present form of mowers, there is a minimum in this point of lightness which should not be exceeded. And we venture to express our opinion that, while some machines are made of unnecessary weight, others are much too light for the general requirements of farmers in this country. With regard to "stoppages" during trial:—There were some impediments which were, in some degree, fatal to all; such as "nests," ant-hills, and stones. But in some machines clogging resulted from a collection of chafed grass in the fingers. In others stoppage was caused by cut grass getting into the gearing, or entangled in the crank. This resulted from these parts occupying a position which favoured the collection of the cut grass, or from want of proper shielding. In one case, a quantity of cut grass was found crammed beneath the connecting-rod and the frame, and the machine was brought to a stand. This probably resulted from want of space, and the lowness of a long connecting-rod.

With regard to the working of the two-horse mowers we noticed, while watching the trials of some of the less perfect machines, a general unsteadiness and vibration in all parts; in others, an apparent heaviness of draught, great tremor of traces, frame, and pole, and evident discomfort of the horses drawing; and our opinion as to the draught of these was fully confirmed by the dynamometer tests.

During the trials of the best machines, on the other hand, we were impressed with the general appearance and perfect balance of all their parts, the steadiness and evenness with which they worked, the ease with which the horses walked in the cleared tracks, and the perfection of the work done. And this superiority of work was more particularly marked when the cutting was done in the same direction in which the grass was laid.

The concluding run was remarkable for the masterly style with which the whole of the ten selected machines went through their work, and the general perfection of work done in a slightly laid crop of grass. We think it is due to the Exhibitors to mention particularly the splendid close and even cutting in this trial of Walter A. Wood, Harrison and M'Gregor, and Hornsby and Sons; and the swathing of Walter A. Wood, Hornsby, and Samuelson, which was simply perfection.

One-horse Mowers.

An effort has evidently been made by the makers to produce a one-horse mower, and this class shows a marked improvement since Manchester. Many are certainly of lighter draught than those exhibited in 1869.

We would take this opportunity to thank the Stewards for the valuable personal aid they rendered us; without which, and the facilities they gave us in every way, these trials must necessarily have lasted several days longer.

James W. Kimber.
H. V. Grantham.
John Hicken.

The following awards were given in by 2 P.M. on Monday, 12th:—

First Prize of 30*l.*, to Messrs. Hornsby and Sons (580), of Grantham.
Second Prize of 20*l.*, to Messrs. Hornsby and Sons (582), of Grantham.
Third Prize of 10*l.*, to Messrs. Hornsby and Sons (581), of Grantham.
Highly Commended, Messrs. Hornsby and Sons (583), of Grantham.
Highly Commended, Messrs. Samuelson and Co. (181), of Banbury.
Highly Commended, Messrs. Samuelson and Co. (183), of Banbury.

Commended, Messrs. Burgess and Key (2824), Holborn Viaduct, London, E.C
Commended, Messrs. Harrison and M'Gregor (741), of Leigh, Lancashire.
Commended, Mr. Walter A. Wood (2437), of Worship Street, London, E.C

Whatever may be the general opinion of judging by tabulatec points, and it may possibly be thought that the Judges hac acted a little too much by rule in this instance, it must not b forgotten that they had hard-and-fast lines laid down for then in the Table of points. By this means the duty of Judges i certainly somewhat simplified; and, however anxious they migh be to encourage any one particular quality, this Table checkec them from attaching undue importance to it. The best machine say upon 500 points, cannot occupy the first position unless i is sufficiently supported in the other 500; consequently th machine gaining the greatest number of total points must tak the first prize, and so on. This Table shows openly how th Judges arrived at their decisions; and the manufacturers had bee previously made aware what importance would be attached t construction, and what to performance.

It is obvious that the drawing up of the Table of points o merit to be awarded requires great care; and it is quite likel that the arrangement of these points is open to more criticisn than the disposing of them.

The press having published erroneous figures of the draught of these machines, as well as of the one-horse mowers, it wa thought advisable to give the following short statement fron the engineers' notes with reference to this class also; and pro bably this plan might be carried out with advantage on futur occasions.

CLASS II.—TWO-HORSE MOWING MACHINES.

NAME.	Catalogue Number.	Draught in lbs. when Working.
Samuelson	181	190·2
Hornsby	583	213·3
Burgess and Key	2824	230·4
Harrison and M'Gregor ..	741	237·9
Picksley and Sims	2446	268·4
Hornsby	582	223·4
Walter A. Wood	2437	235·4
Samuelson	183	212·0
Hornsby	580	227·6
Hornsby	581	217·6
W. Anson Wood	193	206·1

In giving a few descriptions of grass-mowing machines, and illustrations of some important parts of them, it may be expected that those from the extensive and successful firm of Messrs. Hornsby and Sons would occupy our first attention.

Messrs. Hornsby and Sons' Mowing Machines.—Fig. 1 is a plan, and Fig. 2 a side-elevation, $\frac{3}{4}$ inch to a foot, of No. 580, called Paragon o, which took the First Prize. *a* (Fig. 1) is the main axle, made of wrought iron, and free to turn in bearings formed in the main frame *b*, which is of cast iron. It has the ratchet-box *f* keyed upon it, at the side nearest the cutter-bar, with which the road-wheel *e* gears by means of a spring-pawl. At the opposite side is the road-wheel *d*, biting in the same way into a ratchet which is formed in the geared ring, which is also keyed to the main axle. This ring carries 100 teeth, working into the pinion *g*, with 13 teeth, which clutches to the pinion by the wrought-iron spindle *h*, and is thrown in and out of gear by the turnover-lever *i*, which can be acted upon by the foot of the driver. On the opposite end of the spindle *h* is a bevelled wheel and pinion protected from the cut grass by a shield formed upon the main frame. This bevelled wheel *l l* (Figs. 1 and 2) carries 45 teeth, gearing with 13 teeth upon the end of the spindle carrying the crank. This spindle is 25 inches long. The road-wheels are of cast iron, 2 feet 4 inches in diameter, with wrought-iron spokes, and the speed of the crank is 26·62 to one revolution of the road-wheel, *i. e.* $2\frac{2}{3}$ inches to 1 foot of circumference, the crank being $2\frac{5}{8}$ inches' throw. The cutter-bar is steel, and is jointed direct to the main frame by the caps *k k* (Figs. 1 and 2), upon which it joints; consequently, however uneven the surface of the land may be, the crank is always directly in a line with the cutters, and the knife, which is of spring steel $\frac{7}{16}$ in. thick will work equally well at any angle, even when turned up for travelling. *j* is the main-shoe of malleable iron, to which the caps *k k* (Figs. 1 and 2) are bolted, and the front of which forms the slade *p*, carrying the leading wheel; *m* shows, in dotted lines, the position of the pole; *n* (Figs. 1 and 2) is the draught-bar, to which the whipple-trees are attached by the draught-rod. It is brought to a position sideways of the draught-pole, by which means the side draught usually taken by the pole is removed, and the weight of the cutter-bar upon the land is also lightened, so that it has a tendency on meeting with obstructions to rise over them. The driver's seat is received in a socket formed on the pole-bracket, and when the driver is on the seat the whole of the weight of the pole is taken off the horses.

Fig. 3 shows the bridge-iron detached, to which is coupled the pole-casting, shown in Fig. 2, so that the latter may slide upon the bridge-iron to any position to suit the breadth of the horses' walk.

Figs. 4 and 5 show plan and side view of the connecting-rod $\frac{1}{4}$ full size. These are made of spring steel in the centre, with wrought-iron ends welded on them; they are case-hardened. The length, $11\frac{1}{8}$ inches from centre to centre, being the same in No. 581; No. 582 is half an inch shorter.

Figs. 6 and 7 give plan and side view of a finger one-fourth the actual size, and show the inclination of the cut. The finger has steel cutting-plates, top and bottom, which are riveted in and tightly driven into a V-shaped recess at the front end.

Fig. 8 is a diagram on a scale of 3 inches to 1 foot, showing three positions of the knife during one revolution of the crank, which is the same in No. 581 (Paragon n) and No. 583 (the Manchester Mower). *a* is the position of the knife at the extreme throw to the right; *b*, in dotted lines, shows the extreme throw to the left; and *c* the return-position as *a*, after a travel forwards of $3\frac{1}{8}$ inches.

Illustrations of Messrs. Hornsby and Sons' Mowing Machine, No. 580.

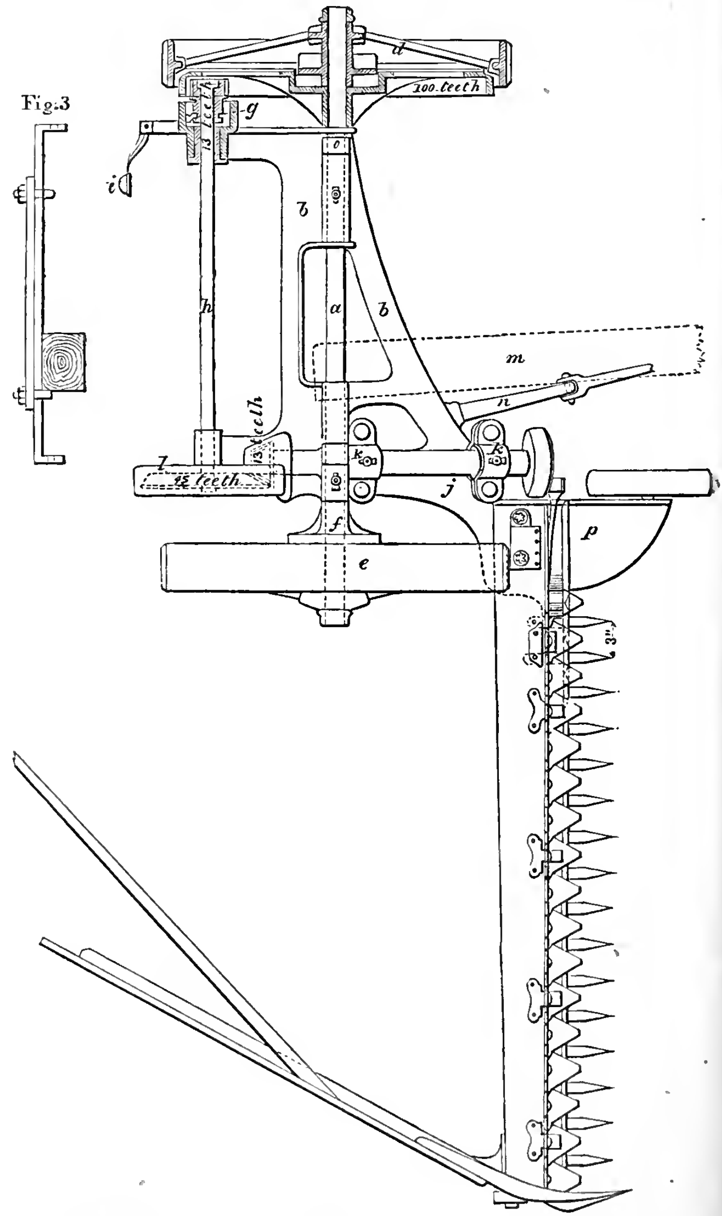


Fig. 3.—Bridge-Iron, detached.

Fig. 1.—Plan.

Illustrations of Messrs. Hornsby and Sons' Mowing Machine, No. 580 *(continued).*

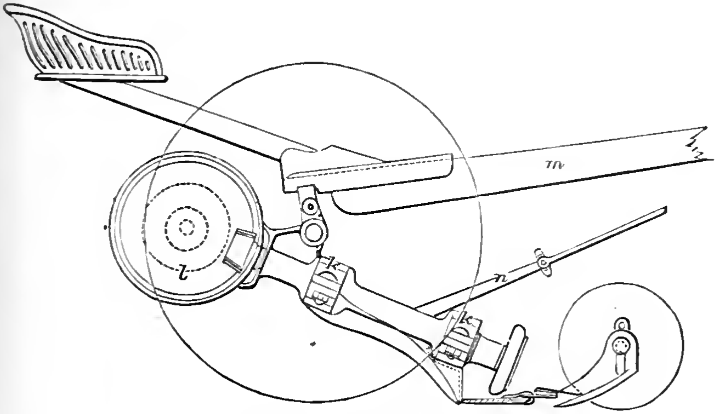


Fig. 2.—Side Elevation.

Fig. 4.—Plan of Connecting Rod.

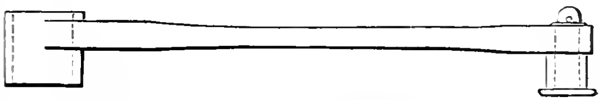


Fig. 5.—Side View of Connecting Rod.

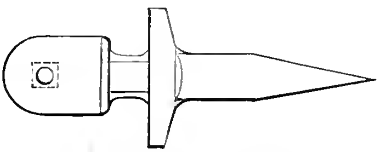


Fig. 6.—Plan of Finger.

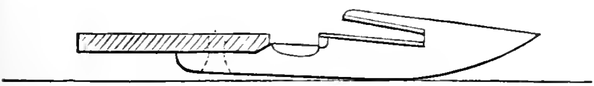


Fig. 7.—Side View of Finger.

Illustrations of Messrs. Hornsby and Sons' Mowing Machine, No. 580 *(continued).*

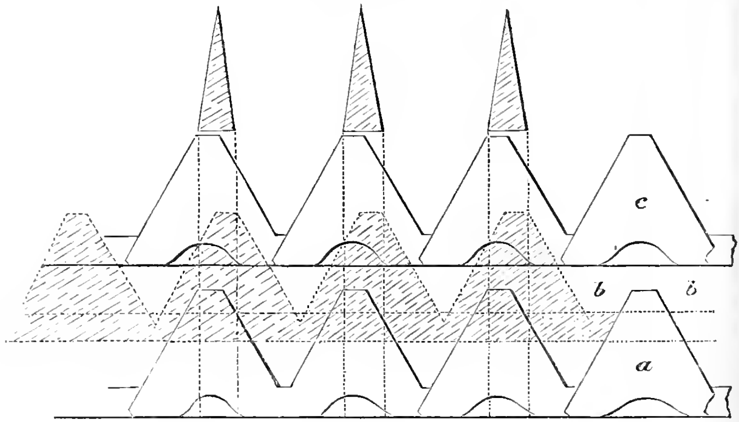
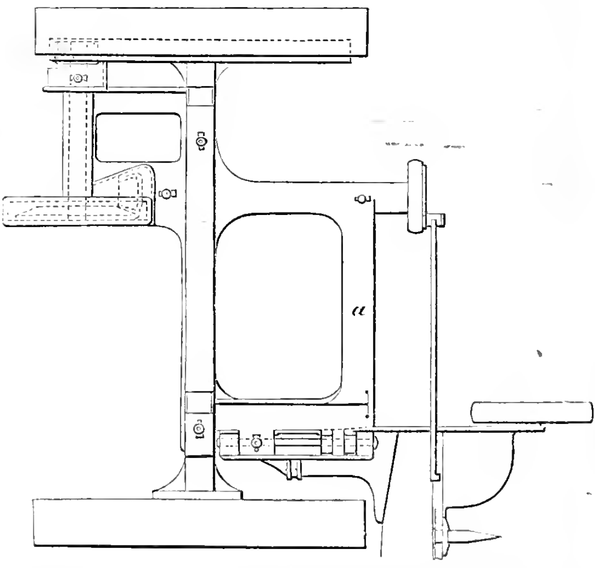


Fig. 8.—Diagram of Knife in three Positions during one Revolution of the Crank.

Fig. 9.—*Plan of Messrs. Hornsby and Sons' Mowing Machine, No.* 583.



No. 582, Paragon A, which gained the Second Prize, can be alluded to without giving a drawing, having plan and gearing on the same principle as No. 580; there are, however, 12 teeth instead of 13 on the spindle carrying the

crank, which gives a speed of 28·89 to 1 revolution of the road-wheel, or 4 to 1 foot of circumference, showing an increase of speed of 2·27 to one revolution of the road-wheel; the fingers are $2\frac{1}{2}$ inches apart; the length of the throw is $2\frac{3}{16}$.

Fig. 9 is a plan of No. 583, by Messrs. Hornsby and Sons, called their "Manchester Mower," on a scale of $\frac{3}{4}$ inch to 1 foot, which the Judges highly commended. The gearing is of the same proportions as in Nos. 580 and 582, but with a finger-bar pin-jointed to the main frame *a*, which is of cast iron, the throw of the crank being the same.

The difference in the arrangement of gearing on the frame, plan of frame, and increased length of the connecting-rod, which is 23 inches, will be sufficiently shown by the drawing.

I commence the description of a few other machines with that of No. 181, made and exhibited by the long-established and extensive firm of Messrs. Samuelson and Co., of Banbury, as it stands high in merit, more especially in respect to lightness of draught; it was also first in number of points after the prize machines, and, with No. 183 by the same maker, was highly commended by the Judges.

Samuelson and Co.'s Mowing Machine, No. 181.—In Fig. 10 is given the full view.

Fig. 11 represents an arrangement for lifting by hand the finger-bar at the the pleasure of the driver, somewhat similar to that in their other machines; but as all cannot be described, it may be of interest to give it here. A is a part of the main framing; B B the shoe and finger-bar; C a chain attached by a loose link to the extension-bar D, running under a half-pulley attached to the frame, and connected with a wood-lever E (Figs. 11 and 12); G (Figs. 11 and 12) is the draught-pole; F shows front view of pulley D, shown in Fig. 12. It will be seen that when the chain is slack the knife is free to act upon its natural bearings; when tightened by the driver pulling back the wood-lever E, the chain pulls down the extension-bar D, which renders the beam rigid from end to end, at the same time lifting the beam and knife over any obstacle.

Fig. 12 shows a side view of Samuelson's peculiar arrangement of the draught-chain, by which, in case of any undue draught, not absolutely necessary in the ordinary working of the machine—such as an obstacle of extraordinary resistance—the knife-bar is raised by the pull of the horses so as to allow it to ride over such obstacles. This arrangement has been applied to all the mowers and combined machines of these makers since 1868. It will be noticed that by the draught being taken from the extreme end of the pole, there is a tendency to raise the other end, and thus, when the machine is cutting, the pressure upon the horse-collar is removed. C C is the draught-chain, one end of which is attached to the whipple-tree, and the other to the tail-end of the pole-bracket A, adjustable by the three holes I I I; it runs under the pulley B attached to the main frame, and over another pulley, D, attached to the front portion of the drawing frame. It will be seen that the draught-chain A can thus be adjusted at either of the three holes, or by varying the position of the pulley B, with respect to the main axle, for which provision is made by having two or more holes in the main frame, to which the pulley can be fitted.

Fig. 13 is a plan of the main shoe, with a part of the knife and finger-bar; and Fig. 14 shows the side view of it. To disconnect the connecting-rod A, in both figures, the spring-catch B is drawn out, and the pawl C, which is pivoted, is raised, and allows the rod A to spring out of the knife-bar head E.

Fig. 14 is the guide to the head of the knife-bar E, and also forms a means of oiling by means of the reservoir for oil, G.

Fig. 15 shows the pawl C, raised to allow the knife-bar head to be disconnected, and the dotted lines show it in its proper position.

Illustrations of Messrs. Samuelson and Co.'s Mowing Machine, No. 181.

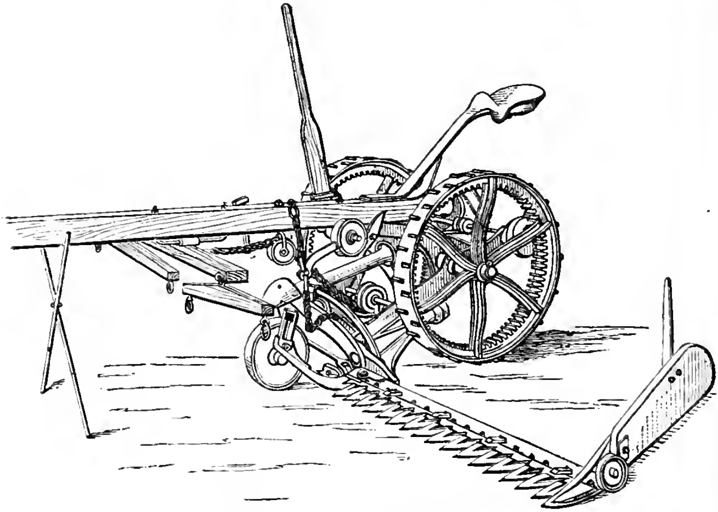


Fig. 10.—View of Machine.

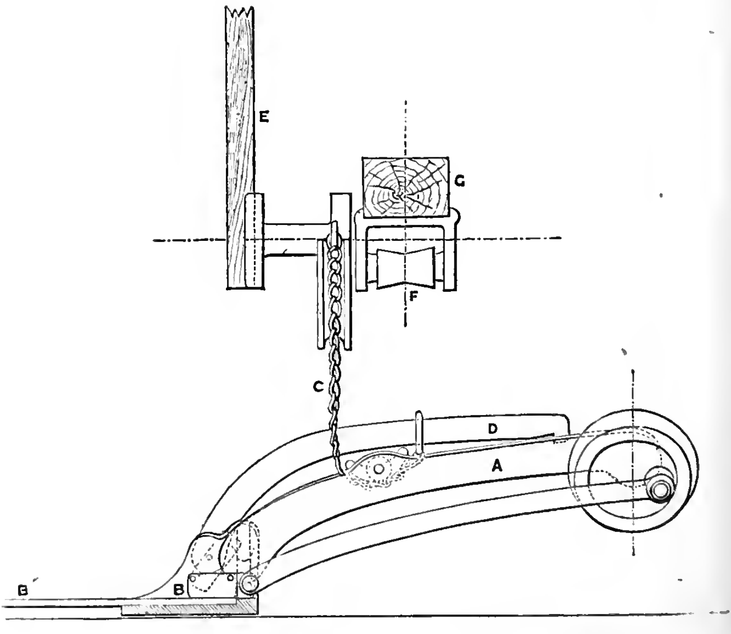


Fig. 11.—Arrangement for Lifting the Finger-Bar.

Illustrations of Messrs. Samuelson and Co.'s Mowing Machine, No. 181 (continued).

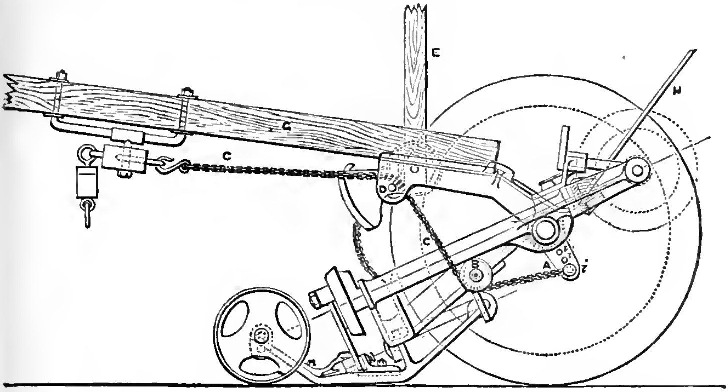


Fig. 12.—Section showing the Arrangement of the Draught-chain.

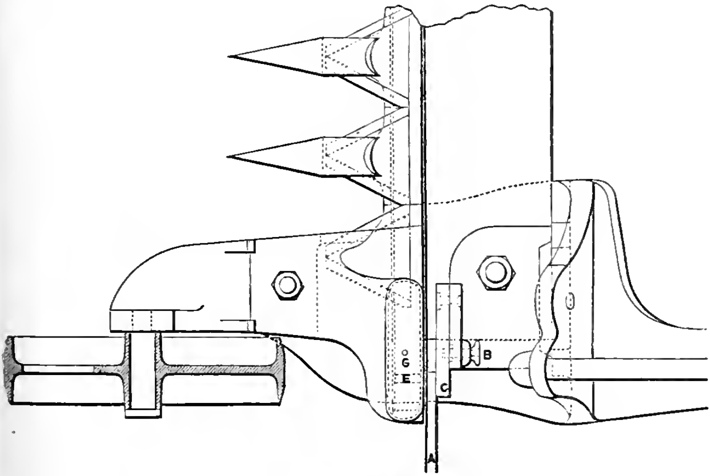


Fig. 13.—Plan of the Main Shoe.

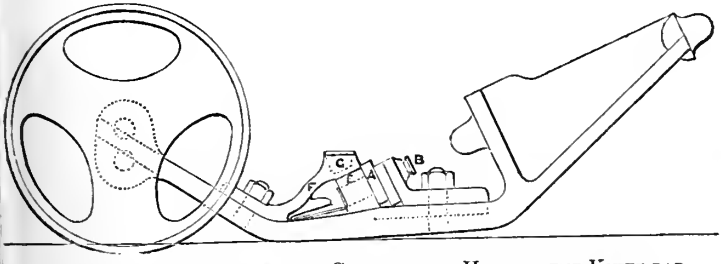


Fig. 14.—Section showing the Guide to the Head of the Knife-bar.

Illustrations of Messrs. Samuelson and Co.'s Mowing Machine, No. 181 (*continued*).

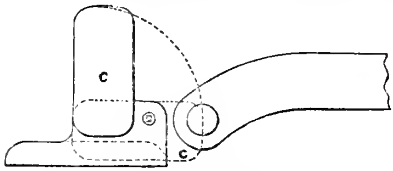


Fig. 15.—Pawl raised to allow the Knife-bar Head to be disconnected.

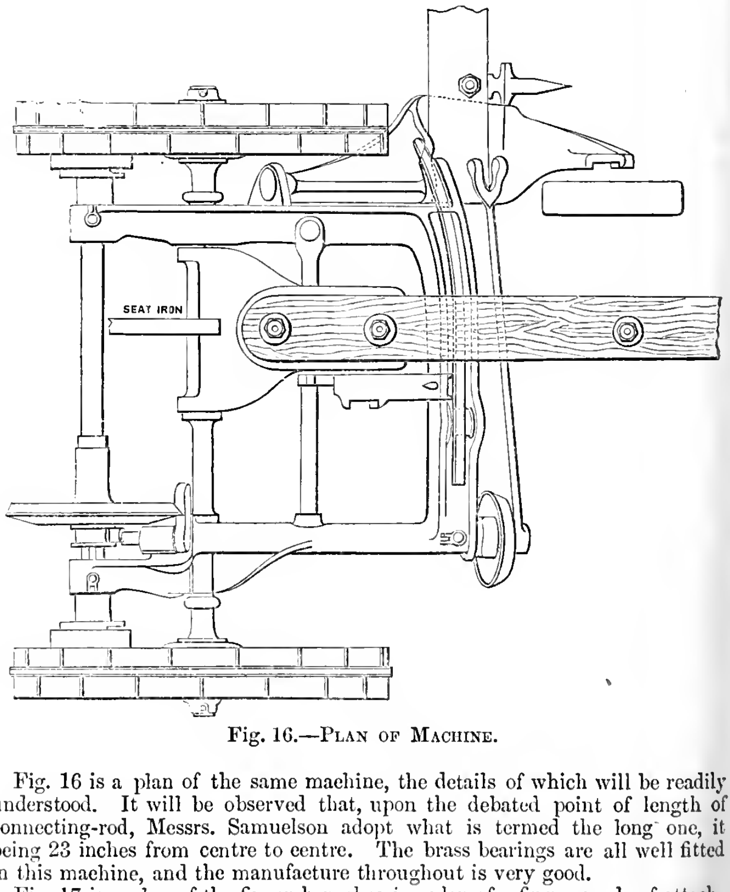


Fig. 16.—Plan of Machine.

Fig. 16 is a plan of the same machine, the details of which will be readily understood. It will be observed that, upon the debated point of length of connecting-rod, Messrs. Samuelson adopt what is termed the long one, it being 23 inches from centre to centre. The brass bearings are all well fitted in this machine, and the manufacture throughout is very good.

Fig. 17 is a plan of the finger-bar, showing plan of a finger, mode of attachment, and knife-holder.

Fig. 18 is a drawing of a detached finger—section at *a* and *b* (Fig. 17),—and shows the exact inclination of cut.

Illustrations of Messrs. Samuelson and Co.'s Mowing Machine, No. 181
(*continued*).

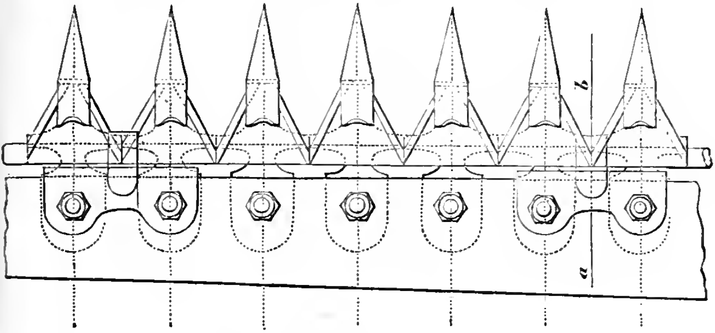


Fig. 17.—Plan of Finger-bar.

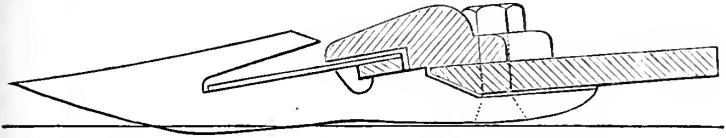


Fig. 18.—Section of Detached Finger at *a b*, in Fig. 17.

Burgess and Key's Two-horse Mower, No. 2824.—I shall now illustrate, by the annexed drawings, the well-made machine by Burgess and Key, No. 2824 (to which the Judges gave a commendation), especially in reference to the position of the knife-bar, which, as will be seen, is different from that of any of the others, being placed nearly in a direct line with the main axle of the machine.

There is in this machine an arrangement for changing the speed of the knife to the extent of 25 per cent.

Fig. 19.—*View of Messrs. Burgess and Key's Two-horse Mowing Machine, No.* 2824.

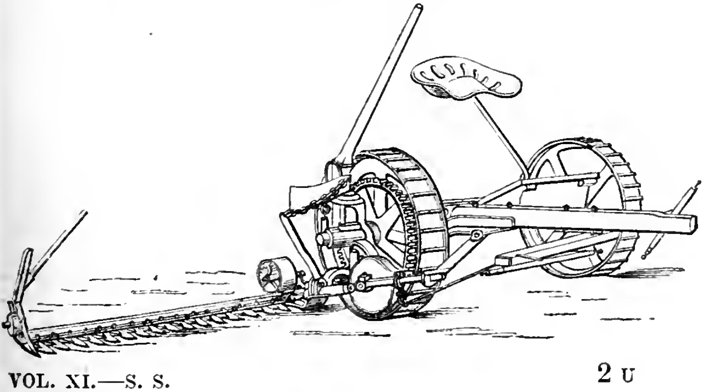
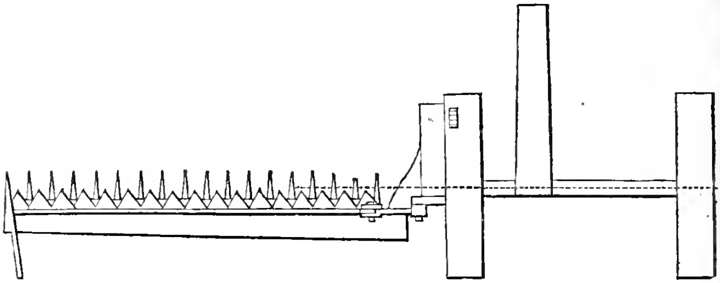


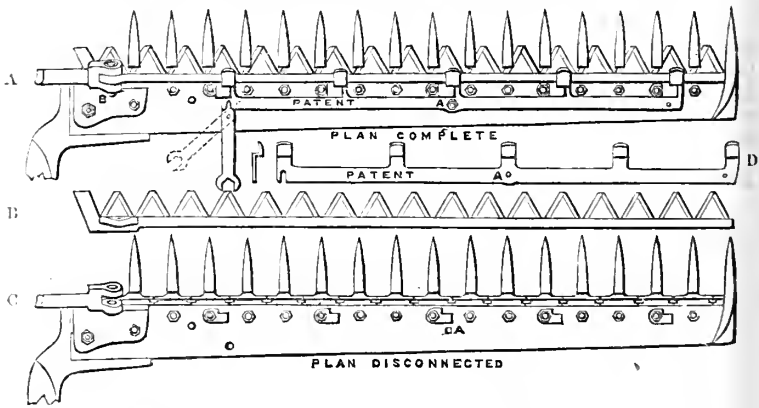
Fig. 20.—*Plan of Messrs. Burgess and Key's Two-horse Mowing Machine, No. 2824, showing the position of the Knife-bar.*



The driving-wheel works on an eccentric bush, which, on being turned round on its own pivot, moves the driving-wheel off from the wheel it gears into, and so admits of the introduction of three pinions of different sizes, by which three different speeds can be obtained.

I also add an illustration of their arrangement for taking out the knife by giving plans of the cutter-bar, with and without the knife, of the knife, and of the fastener.

Fig. 21.—*Illustrating the Arrangement for taking out and fastening the Knife in Messrs. Burgess and Key's Mowing Machine, No. 2824.*



A. Cutter-bar with knife and fastener complete, B. Knife disconnected.
C. Cutter-bar without knife. D. Patent Fastener.

I cannot avoid drawing attention to the increased danger to the driver in proportion as the cutter-bar is brought farther back. Obstacles in practice will occur, giving the machine a sudden stop; horses will take fright and gallop away with machines, and pitch the driver forward; and the farther back the knife is, the more danger there appears to be.

Harrison and M'Gregor's Two-horse Mower, No. 741.—The figures illustrating this machine, which is called the Albion Mower, consist of a plan and

Figs. 22 and 23.—*Plan and Transverse Section of Messrs. Harrison and M'Gregor's Mowing Machine, No. 741.*

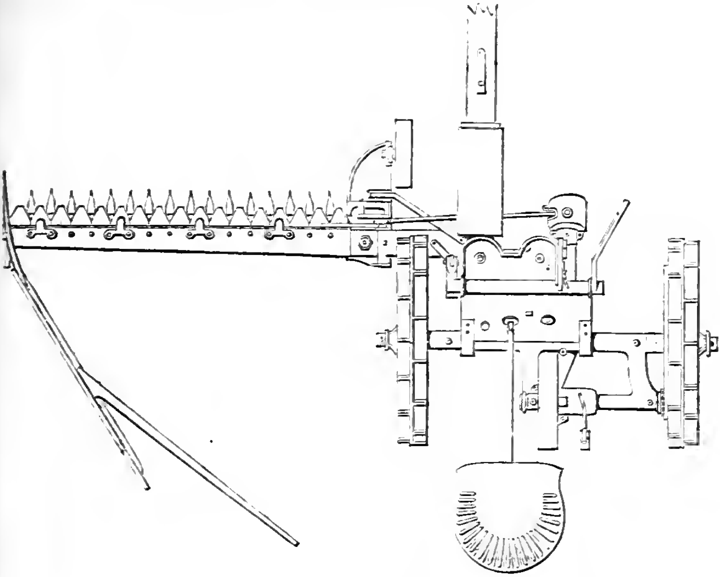


Fig. 22.—Plan.

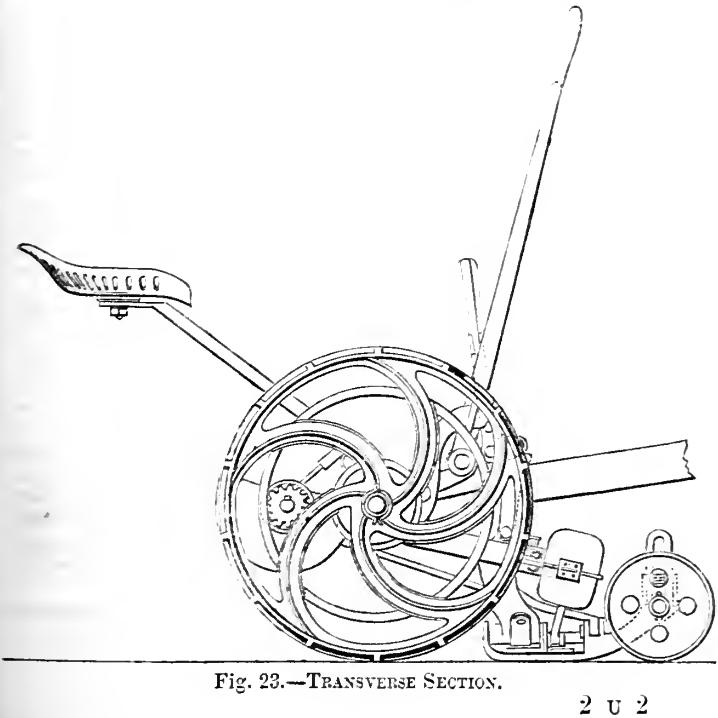
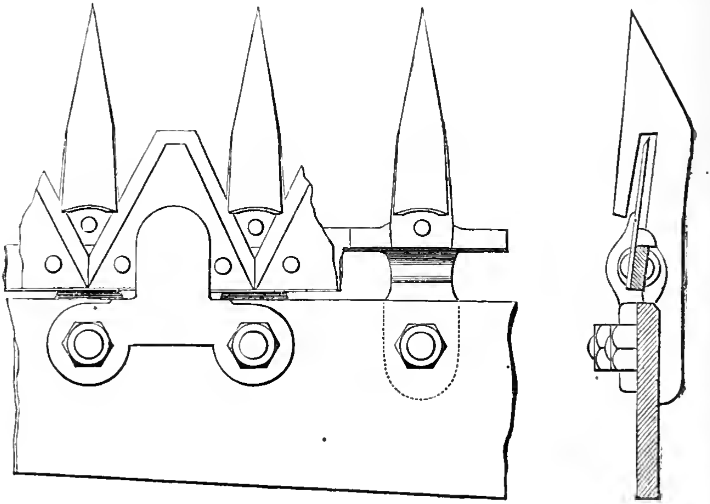


Fig. 23.—Transverse Section.

Fig. 24.—*Plan of part of the Knife-bar* (A), *and Section of one of the Fingers* (B), *in Messrs. Harrison and M'Gregor's Mowing Machine, No.* 741.



A B

section of the machine, plan of part of knife-bar with fingers, and a section of one of the fingers fitted with steel cutting plates. This machine received a commendation from the Judges. It is supplied with a tipping lever for raising and lowering the points of the fingers and cutters. The diameter of the road-wheel is $28\frac{1}{4}$ inches. The crank-shaft makes 27·08 revolutions to one of road-wheel. The length of the knife-stroke is $2\frac{3}{4}$ inches. The forward traverse of the machine for one cut of the knife is 1·638 in. The various parts will mostly be seen by the drawings; and so many of the parts having been described in previous machines, it is unnecessary to go further into particulars. I may, however, say that there is a top and bottom frame; the former carrying the pole, driver's seat, and lifting-gear; the latter the driving-gear and cutting apparatus. These are connected by a pair of wrought-iron straps round the tube covering the main axle, and by an adjustable lever and link at the forward ends, so as to allow the angle of inclination of the bottom frame to be altered, and with it the inclination of the fingers.

Walter A. Wood's Mowing Machine.—This machine, No. 2437, by Walter A. Wood, cannot be passed over without special reference. It is of American manufacture, and was first introduced into this country in 1858, since when it has been extensively patronised here.

This firm has confined its attention to the manufacture of mowing and reaping machines since 1852, and, it is said, turns them out of their own works at the rate of one every five minutes; it is credited with making more than any other firm in the world. The machines are imported direct from New York to about a dozen ports in this country, and duplicates are kept at many places. Mr. Wood, like most of the larger manufacturers in this country, has printed lists of prices of these duplicates.

The Judges have alluded to the excellent and close cutting of this machine, to which they gave a commendation.

The materials used in the manufacture of this machine have the reputation

of being of superior quality. Mr. Wood's agent, in describing it to the Judges, stated that the driving-wheels, main-frame, toothed-wheels, main shoe, and wheels in shoe, were made of Pennsylvania cast iron. This iron has a high reputation amongst engineers for its toughness and tenacity, being in the last-named quality nearly twice as good as ordinary English cast iron; and most of the wheels of locomotive and other rolling-stock on the railways of the United States are made of it.

The cross and crank-shafts, the axle, cutter-bar, and knife-bar, are of cold rolled-iron, which is said to be stiffer and harder than ordinary bar-iron; the guard-fingers and dividing-shoe are of malleable iron, steel-faced, and the connecting-rod is of the best Swedish iron.

In Fig. 25, A marks one of the travelling-wheels, 28 inches in diameter, upon which is cast the master-gear D, with 88 cog-teeth, each working into the spur-pinion X. The lower ends of the standards for the driver's seat are inserted into the cast-iron pole-socket resting on the main axle, to which is bolted the pole C. P is the draught-rod attached to the main frame at S. The hand-lifting lever is H, and the quadrant to the same V. The draught-pole and bar are so placed as to balance the machine upon the main axle by the weight of the driver, and also to avoid as much as possible all unnecessary side strain.

Fig. 25.—*Side Elevation of Mr. Walter A. Wood's Mowing Machine, No. 2437.*

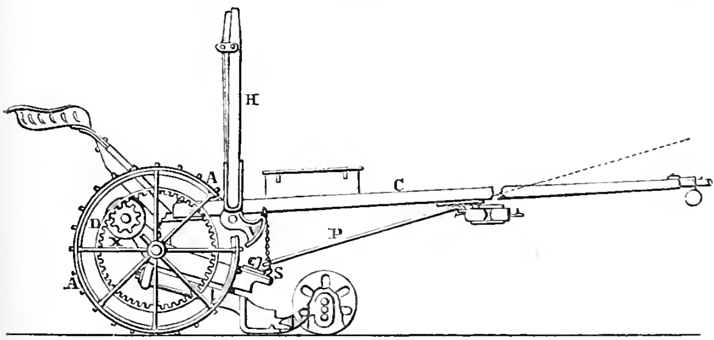


Fig. 26 represents a plan of the same machine. The spur-pinions X are fixed on the cross-shaft G, with 12 teeth, each provided with ratchet and pawls; so that if either or both wheels advance they cause the shaft to rotate. On this shaft is placed the bevelled-gear *d*, having 45 teeth, working into the bevelled pinion *h*, with 12 teeth, on one end of the crank-shaft, which is 22 inches long, having 18 inches bearing and oilers, shown by T. The crank I being at the other end of this shaft, drives the connecting-rod U, 22½ inches long, which works the knife, making fifty-four vibrations to one revolution of the driving-wheel, or 7·4 to one foot. The inclination of this rod is 6½ inches, the crank end being 9½, and the knife end 3 inches from the ground. The crank is $1\frac{5}{16}$, vibrating the knife $2\frac{5}{8}$ inches. The main frame B rests upon the main axle, having hard gun-metal tubular bearings. To the front of the main frame is attached the cutter-bar J, by means of the main shoe E, also the lateral spring F. *l l* shows the clutch in and out of gear; *f* is the lever for locking the bevelled-gear; *g* is the arm of the main frame to support the clutch-lever.

Figs. 26 and 27.—*Illustrations of Mr. Walter A. Wood's Mowing Machine, No* 2437.

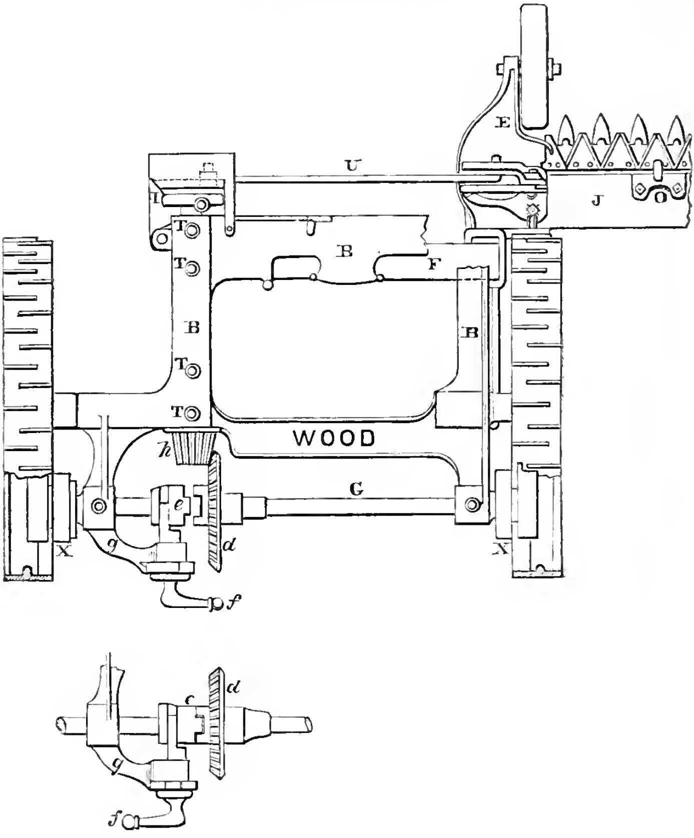


Fig. 26.—Plan.

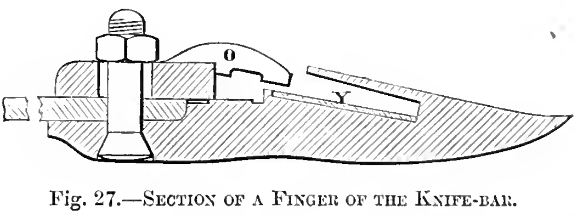
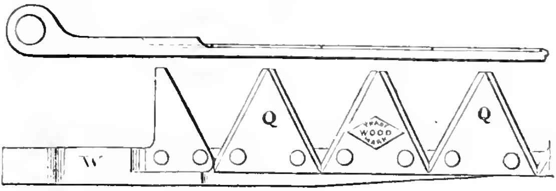


Fig. 27.—Section of a Finger of the Knife-bar.

In Figs. 26 and 27, o is the knife-holder; y, steel-facing. In Fig. 28, q are sections of knife; w is the knife-bar. In Fig. 29, l is the dividing-shoe; z, a small wheel in the dividing-shoe; m, the swathing-board.

Figs. 28–30.—*Illustrations of Mr. Walter A. Wood's Mowing Machine, No. 2437 (continued).*

SECTION.



PLAN.

Fig. 28.—SECTION AND PLAN OF PART OF THE KNIFE.

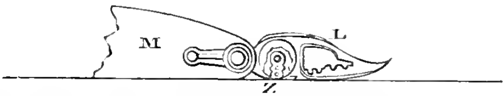


Fig. 29.—DIVIDING SHOE AND PART OF SWATHING BOARD.

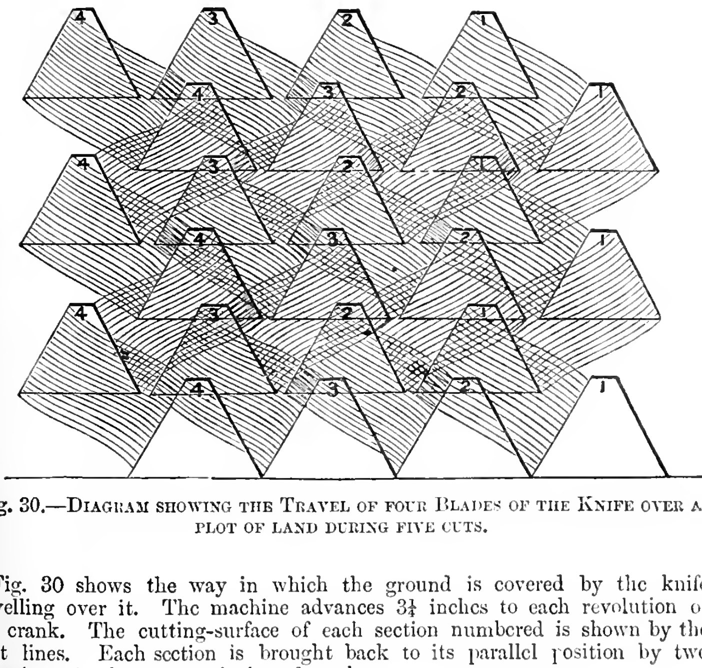


Fig. 30.—DIAGRAM SHOWING THE TRAVEL OF FOUR BLADES OF THE KNIFE OVER A PLOT OF LAND DURING FIVE CUTS.

Fig. 30 shows the way in which the ground is covered by the knife travelling over it. The machine advances 3¼ inches to each revolution of the crank. The cutting-surface of each section numbered is shown by the faint lines. Each section is brought back to its parallel position by two vibrations, *i.e.* by one revolution of crank.

Class III.—Hay-Making Machines.

Following the usual course of trials, the hay-making machines were again tested in the same year as the grass-mowers, and have not been tried by the Royal Agricultural Society since the Manchester Meeting in 1869.

It is well known that these are really labour-saving machines, of especial use, in our changeable climate, at a time when every minute of sunshine requires to be made the most of. The great majority of these machines do not appear to have been much improved since the last trials; but the back-action, so much in favour with many farmers, as having less tendency to thresh out the hay-seeds, has nevertheless received much attention by most manufacturers. An attempt has also been made by one maker to catch up the hay run over by the travelling wheels of the machine. This has entailed more complication; for, as was thought by the Judges at a former trial by this Society, by keeping the fork-action upon the main axle, strength and simplicity are gained; also the forks, by working directly between the wheels of the carriage, sufficiently adjust themselves to the inequalities of the ground. Perhaps one of the greatest novelties at these trials was a hay-making machine having a hood completely covering the front action of the forks.

The Prizes offered were—

	£
For the best Hay-making Machine	20
For the second best	10
For the third best	5

Mr. J. Thompson, Badminton, Chippenham; Mr. J. D. Ogilvie, Mardon, Cornhill, Northumberland; Mr. W. Cranfield, Buckden, Hants, officiated as Judges. The same instructions were given to them as to the Mowing Machine Judges, and the following Table of points of merit had been previously arranged for them and published:—

1. Mechanical construction and workmanship, with soundness and quality of materials	300
2. General arrangement of machine and its gearing, including forward and back action, simplicity and lightness, combined with strength	200
3. Arrangement and adaptation of machine for working on uneven ground	150
4. Perfection of work done on trial, including freedom from clogging and ease of management	300
5. Price	50
	1000

It was fortunate that a fine day, and a heavy crop of grass, estimated at over two tons of hay per acre, cut the previous day by the machines, awaited the Judges on Tuesday, July 6.

Thirteen machines out of fourteen entered for trial were arranged in the field, when, in consequence of some extraordinary and mysterious idea, the manager of a distinguished firm which had entered for trial five of their hay-making machines and six horse-rakes, and had allowed them to be brought into the trial-field, received a telegram from his employers to withdraw them all. The Judges, after conferring with the Stewards, would not consent to such an unprecedented course as their being taken back for exhibition in the Showyard, and insisted upon having them tried, against the instruction of the firm to their manager, who protested that his position with his firm was in danger. After this delay the trials commenced, which continued the whole day, with 5 from Nicholson and Son; 2 from R. Boby; 2 from Ashby, Jeffery, and Luke; 2 from the Reading Iron Works; 1 from W. Affleck; and 1 from Beare, Son, and Co.

The Judges were not prepossessed by the appearance of No. 201, exhibited by Messrs. Ashby, Jeffery, and Luke, furnished with a hood, but upon trial they found it the only machine that did not clog. The hood is made of a light framework of wood, covered with canvas; it is light, but certainly not very durable. They found a current of air created under the hood, which assisted the forks in ridding themselves of the hay. The hay being confined by the hood, there appeared less disposition to shed out the grass-seeds, and it was found that the hay was left particularly light upon the ground after it. The adjustments of this machine were very simple.

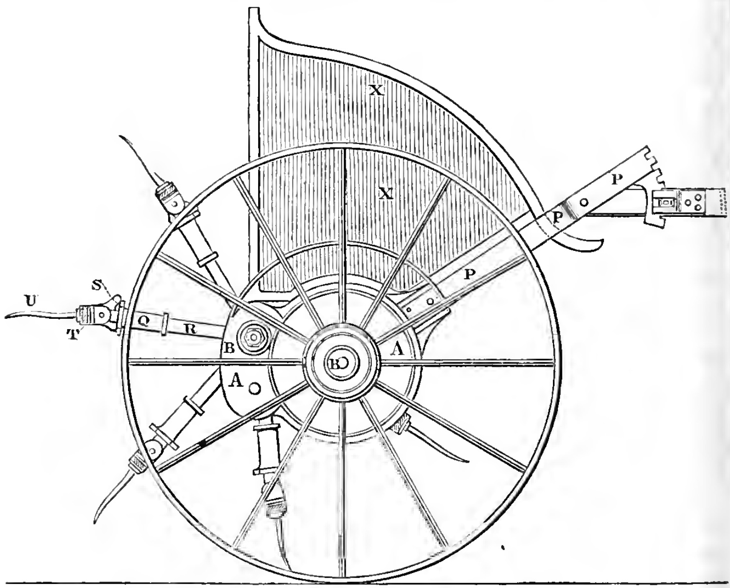
Unfortunately, the dynamometer was so much engaged with the grass-mowers, that the draught was not tried by it. But upon this point the Judges were satisfied that it would not be more than, if so much as, some other machines, the friction of the hay against the hood being more than counterbalanced by the current of air completely relieving the forks of the smothering effect of a heavy crop, which caused so much clogging, loading of the shafts, &c., in other machines. During the trial there was a strongish breeze, which, however, did not interfere with the working of the machine either way. The Judges had no difficulty in deciding to give this machine the First Prize.

A summary of the results of the trials is given in Table III., facing page 635.

Ashby, Jeffery, and Luke's Haymaking Machine, No. 201.—A in Fig. 31 shows the cast-iron framing of this machine; B (Figs. 31 and 32) the main

axles; X, the hood, encompassing about one-quarter of the circumference of the path of the revolving forks, and closed on the top and both sides. By using this hood, in place of a wire screen, the machine is more compact, and the horse is about three feet nearer to his work. The machine is adjustable either higher or lower—to suit various crops—as follows: in the ends of the draught-shafts are two holes, with studs or pins, which studs are firmly fixed to the side-irons, P, the shafts being moveable on these studs; the side-irons are prolonged to form quadrants, with notches for the reception of a bolt which passes through the centre of the shafts at a distance from the studs to suit the radius of the quadrants. This bolt is made to slide in gear with these notches.

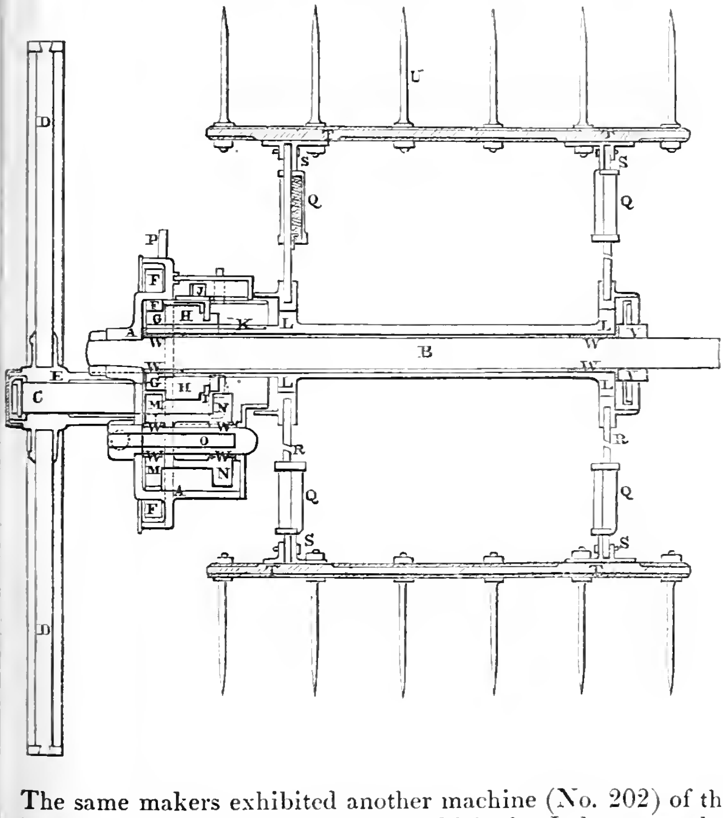
Fig. 31.—*Side View of Messrs. Ashby, Jeffery, and Luke's Hay-making Machine, No.* 201.



In Fig. 32, F is a cogged wheel, fixed on the nave of the travelling-wheel D, revolving with it; G and H are pinions cast together, having a sliding motion on a fast key, K, on the end of the barrel L; carrying the fork-bars R with the teeth. This barrel revolves on the main axle, and is put in motion by a lever for the three actions. When it is required to put the machine out of gear, the sliding pinion is withdrawn from the sliding cog-wheel, and becomes idle. The sliding pinion has a groove, I, turned on it for the reception of the fork J, which is moved by a jointed lever working on a fixed centre-pin. One end of the lever engages the fork, the other end has a jointed handle, working round a quadrant, having three notches, representing the three actions of the machine, viz., forward, out of gear, and backward, or reverse action, in such a way that when the lever is put opposite the required notch, the handle is turned down and locks itself. The backward or reverse action is obtained from another double pinion, N N and M M, working on a hollow bolt. One of the cog-wheels

f this pinion is always in gear with the driving cog-wheel; hence it will be ;en that when the double sliding pinion is withdrawn from the driving cog- 'heel, and slid by the lever to the proper extent, the larger cog-wheel H H of he sliding pinion becomes geared with the other cog-wheel of the double inion, and so reverses the action of the machine. These arrangements give high speed for the forward, and a slow speed for the backward action. Q Q Figs. 31 and 32) show the springs and boxes for the forks; S S, brackets for ttaching ring-irons, R, to the fork-bar; T T are the fork-bars; U, the fork-tines. ' represents gun-metal bushes for the wearing parts; V is a cast-washer to eep the barrel in position; L is a barrel for working the fork-bars; O is a ollow double pinion bolt, to contain oil for lubricating the gun-metal ushes in the double pinion.

Fig. 32.—*Plan of Messrs. Ashby, Jeffery, and Luke's Hay-making Machine, No.* 201.

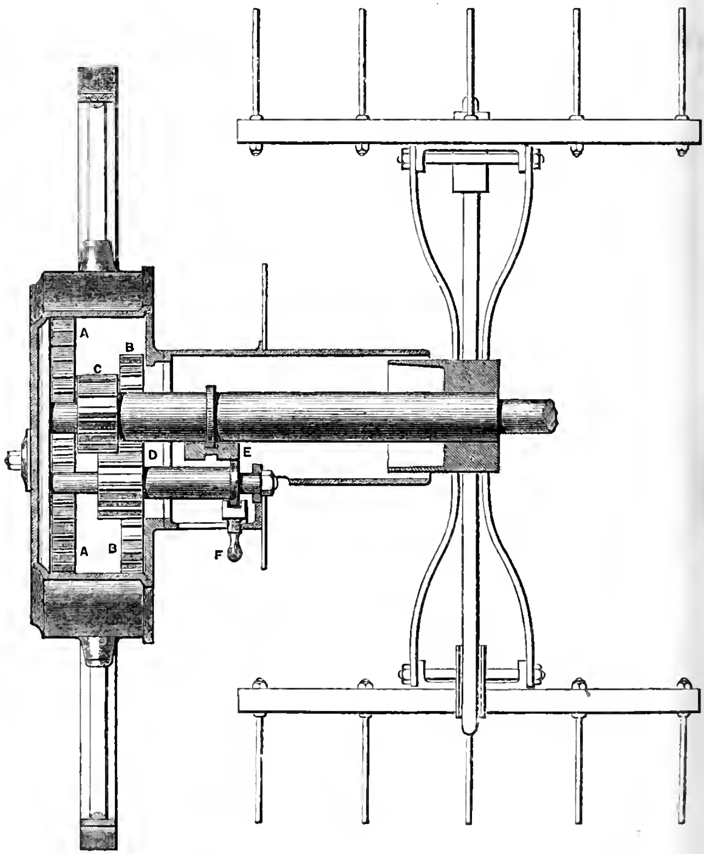


The same makers exhibited another machine (No. 202) of the ordinary form, without the hood, to which the Judges awarded he Second Prize; they did not consider it worked so efficiently

as No. 201. They gave Third Prize to No. 426, and commend No. 427, both from the Reading Iron Works Company, and bo of which worked well. They also commended No. 1024, fro Nicholson and Son, and especially approved of its simple ar efficient locking attachments.

Nicholson and Son's Hay-making Machine, No. 1024.—The accompanyi sketch shows the locking attachment of this machine: A and B are the intern

Fig. 33.—*Plan of Messrs. Nicholson and Son's Hay-making Machin No.* 1024.



and external driving-wheels carried inside the boss of the machine-wheel; they have a space between them rather wider than the pinions C and D, to allow them both to remain out of gear when the machine is travelling. The pinion C, when in gear with the internal wheel A, gives a fast backward action to the machine, and when C is in gear with B, a slow forward action; when the pinion

is in gear with B, as shown in the sketch, the machine will be in slow back-ırd action, and when D is in gear with A, in fast forward action. In order to event the pinions C and D from both coming into gear at the same time with her one or both of the wheels A and B, an interlocking lever, E, having only vertical motion, is placed between the prolonged bosses of the pinions. Each ss carries a collar, which is opposite the one to the other. When both pinions e out of gear the interlocking lever has corresponding recesses in its upper and wer sides, and is of such a thickness that only one pinion at a time can be pped past it, the other pinion having its collar locked fast in the recess. F ows a handle for sliding the intermediate pinion, without the necessity of tting the hand into the axle-casing.

The working of the other well-known machines of Nichol-n and Son did not come up to their performance at Man-ıester. A recent alteration has been made in the casting of e head of the rake upon which the spring acts, and which lowed the rake to spring back when too little resistance was fered.

The speed of the forks in No. 934, by R. Boby, was found o great in the forward action, throwing the hay about sadly o much. The back-action was fair.

No. 935, by the same maker, was a light machine, much too ght for the crop it had to contend with, and failed to get rough.

The Judges wish it to be known that they cannot recommend light-made machine for this operation generally.

They also wish attention drawn to Beare and Son's entry, No. 294; it had no forward action, but two backward speeds. An tempt is made in this machine to adapt itself in a particular anner to uneven ground, and they think advantage may be ken of this principle, although they are unable to speak vourably of the work it performed. No illustration is given this machine, as it is evidently in a state of transition.

Awards.

First Prize of 20*l*., to Ashby, Jeffery, and Luke (201), of Stamford.
Second Prize of 10*l*., to Ashby, Jeffery, and Luke (202), of Stamford.
Third Prize of 5*l*., to the Reading Iron Works Company (426), Reading.
Commended, the Reading Iron Works Company (427), Reading.
Commended, W. N. Nicholson and Son (1024), of Newark-on-Trent.

Class IV.—Self-acting Horse-Rakes.

The importance of having a good, sufficiently strong, and rrectly constructed horse-rake, whether belonging to this class Class V., is very great, as probably every farmer occupying) or 80 acres of land has (or ought to have) one, whilst larger

farmers have two, three, four, or more. This is the first time the Society has offered prizes for self-acting horse-rakes—although an encouragement was offered last year by one of the Society's medals being given to such an arrangement; it means that the power of the horse is by an appropriate mechanical arrangement employed in liberating the load as well as in drawing the rake, so that a boy or weakly person can manage it. In some cases, such as in damp weather, the corn or hay becomes fixed in the rake, while the horse still keeps advancing, and the rake rides over the ground with a full load before the attendant can liberate it. It is in such cases that this appliance is found to be of special advantage. A minute of the Implement Committee explained, "that it is not necessary that horse-rakes competing in Class IV. should be absolutely self-acting, but that absolute self-action will be considered a point of merit." The same Judges officiated for the two classes of Horse-rakes as in the trials of Hay-making Machines.

The following printed Table of points of merit had been previously drawn up and published:—

1. Mechanical construction and workmanship, with soundness and quality of materials	250
2. Simplicity and lightness, combined with strength	100
3. Shape and capacity of rake teeth, with their mode of attachment	100
4. Mode of adjusting teeth to suit various kinds of work ..	100
5. The simplicity and efficiency of the self-acting arrangement	200
6. Perfection of work done	200
7. Price	50
	1000

Seven machines were brought to trial: 2 by Haughton and Thompson, 2 by Nicholson and Son, 1 by Rollins and Company, 1 by Page and Company, and 1 by Whiteside and Company.

They were tried upon a heavy crop of hay, and upon land partly cleared; and a summary of the results is given in Table IV. annexed.

The First Prize was awarded to No. 1037, manufactured by Nicholson and Son, with the same self-acting principle as was shown in the drawing in last year's 'Journal'; but as some additions have been made to it, a drawing of the machine as at present made is given in Fig. 34.

The Judges considered the shape of the tooth the best in the class, and that the manufacture altogether was good.

Nicholson's Self-acting Horse-rake, No. 1037.—Fig. 34 represents a transverse section, showing the arrangements of both the self-acting and hand-leverage for lifting the teeth. The teeth A A, of which there are twenty-

TABLE IV.—SUMMARY OF RESULTS OF TRIALS OF SELF-ACTING HORSE-RAKES (CLASS IV.).

There were 11 Entries for Trial; of these, 7 were tried in Meadow Grass.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
				CONSTRUCTION.					POINTS OF MERIT.								
NAME OF EXHIBITOR.	Catalogue Number.	Order of Trial.	Price.	Diameter of Wheels.	Distance between Centres of Wheels.	Effective Width.	Number of Teeth.	REMARKS.	Mechanical Construction and Workmanship with Soundness and Quality of Materials.	Simplicity and Lightness combined with Strength.	Shape and Capacity of Rake-teeth, with their Mode of Attachment.	Mode of Adjusting Teeth to suit various kinds of Work.	The Simplicity and Efficiency of the Self-acting Arrangement.	Perfection of Work done.	Price.	Totals.	AWARDS.
									PERFECTION BEING								
									250.	100.	100.	100.	200.	200.	50.	1000.	
Haughton and Thompson ..	2773	1	£ s. 13 13	4′ 0″	7′ 3″	6′ 2″	26	The rake is tipped when driver lowers a catch in a pawl worked by gearing from wheels.									
Rollins, J. G., and Co.	2393	2	10 10	4 4½	7 10	7 0	24	When catch is dropped into gear the teeth are raised; arrived at a proper position the catch is pressed by coming in contact with a set screw, and the teeth fall.	100	50	30	60	120	50	30	440	
Nicholson and Son	1036	3	12 0	3 6	8 0	6 10	28	There are many means of adjusting this machine. See remark on 1037.									
Page, E., and Co.	352	4	11 10	3 6	7 11½	6 6	27	The wheel is locked to raise rakes by means of a friction clutch worked by foot lever.	150	60	70	..	100	130	30	510	
Haughton and Thompson ..	2774	5	14 0	4 0	7 10	6 9	..	The arrangement is the same as 2773; works very easily.	200	70	80	75	180	150	35	790	Second Prize.
Whiteside and Co.	1948	6	10 10	4 6½	8 3	7 0	..	Wooden frame; round teeth.									
Nicholson and Son	1037	8	13 15	4 0	8 0	6 9	28	This machine can be adjusted to rake along the ridge and furrows by raising the teeth either at each end or in the middle of machine. It can be used also as an ordinary rake worked by driver or by follower.	210	80	100	90	170	180	45	905	First Prize.

To face page 662.

Table V.—Summary of Results of Trials of Horse Rakes not Self-acting (Class V.).

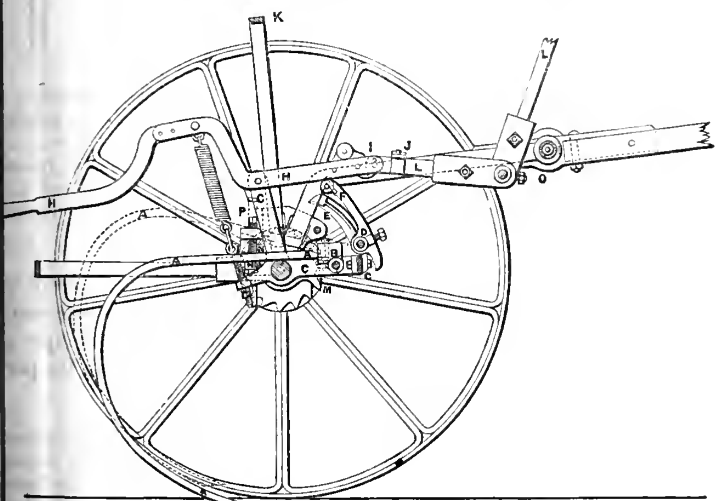
There were 24 Entries for Trial; of these, 19 were tried.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
				Construction.						Points of Merit.							
Name of Exhibitor.	Catalogue Number.	Order of Trial.	Price.	Diameter of Wheels.	Distance between Centres of Wheels.	Effective Width.	Number of Teeth.	Shape and Materials of Teeth.	Remarks.	Mechanical Construction and Workmanship with Soundness and Quality of Materials.	Simplicity and Lightness combined with Strength.	Shape and Capacity of Rake-teeth, with their Mode of Attachment.	Mode of Adjusting Teeth to suit various kinds of Work.	Perfection of Work done.	Price.	Totals.	Award.
										Perfection being							
										250.	100.	100.	100.	200.	50.	800.	
			£ s.	ft. in.	ft. in.	ft. in.											
Tasker, W., and Son	704	3	10 0	3 1½	7 4½	6 10	24	Steel	Worked by driver, or by man following.								
Wright, James	701	4	8 10	3 1	7 5	6 9	24	Steel	Ditto ditto								
Haughton and Thompson ..	2775	5	9 15	4 0	6 6½	5 7¾	21	Teeth 2' 1" diam. ..	Arm for raising teeth behind; driver holds arm in position by dropping trigger into notch.								
Boby, Robert	938	7	10 0	3 6	7 3	6 4	21	Steel	When the teeth are lowered the machine is put back a few inches to pick from last deposit.								
Wright, James	702	8	9 0	3 9½	7 5	6 8	21	Steel									
Pickslev, Sims, and Co.	2447	9	12 0	4 0	6 10	5 9	24	Steel	The teeth were set too far in ground.								
Albion Iron Works Co.	2337	10	12 0	4 0	7 6	6 10	28	Teeth of H Section	Drags hay, but does not fill the teeth.								
Page, E., and Co.	353	11	9 10	3 0	8 1	6 9½	28	Steel	Teeth too small. When very full does not empty. Cleans up well.								
Nicholson, W. N., and Son ..	1035	12	12 15	4 0	6 9½	5 9	24	Teeth of H Section	The axle trussed, seat for driver on truss. Good rake. Worked well whole length of plot without emptying.	220	90	100	90	180	35	715	Highly Commended.
Ditto ditto	1033	13	10 0	4 2	6 8	5 9½	21	Teeth are keyed into casting by taper key.	Only back delivery. Worked 1½ time across the plot without emptying.	230	90	100	90	180	40	730	Second Prize.
Albion Iron Works Co.	2336	14	9 10	3 5½	6 8	5 10	21	Teeth of H Section, steel axle.	Delivers behind or before. Made well, good machine; not good work.								
Reading Iron Works	424	15	10 15	3 5	8 6	7 2	28	Teeth of H Section									
Rollins, J. G., and Co.	2392	16	10 10	4 6	8 4	7 2	25	Round steel teeth ..	Wooden frame. Not set right; teeth adjusted by a set pin.								
Reading Iron Works	425	18	10 15	3 5	7 5	6 1	24										
Boby, Robert	936	19	10 10	4 0	7 1½	6 2½	24	.. ..	Works very well, either worked by driver or follower.								
Nicholson and Son	1034	20	11 10	3 6	7 10	6 10½	28	Teeth of H Section	Two teeth are clipped together.. Trussed axle ..	240	90	100	90	180	45	745	First Prize.
Boby, Robert	937	21	10 10	4 0	7 6	6 4½	21										
Sainty, J. and B.	68	22	6 6	none	7 7	..	31	.. ..	American reversing rake, with continuous teeth. Not well managed, did bad work.								
Boby, Robert	939	23	10 0	3 6	7 5	6 5	24	Teeth pinned into casting.	Wooden wheels. Raked well, but teeth are too small.								

To face page 663.

ght, are of steel, and have their front-ends pivoted on the bar B, which is rried by the frame C, which is capable of being moved round the main axle a centre; over the frame C, and turning on bearings attached to it, are the wl-bars D, divided in the centre of the rake, and carrying at their outer ds a pawl, E, and on their inner ends the stops F. The lever H is jointed ar its middle to an arm of the frame C, and its outer end has a rule-joint, by which it is attached to the hand-lever L. On the cranked arm of this ver is a treadle, J, which can be depressed by the foot of the driver, or by e hand-lever L being pulled towards the seat-iron K, or the inner end of H ted up. The lock formed by the rule-joint I is broken, and the stud, as own above the letter F, attached to the lever H, is depressed, releasing the stop which held the pawl E from falling into the teeth of the ratchets formed both the bosses of the carrying-wheels. Upon the pawl E thus falling into ar, the revolution of the wheels carries the frame C with them, and thereby ts and empties the rake-teeth. When the rake-teeth have been lifted high ough the cam M throws the pawl E out of gear with the ratchet, thereby lowing the teeth to drop back into the proper position for raking. By ving duplicate pawls, and the pawl-bar in two parts, it allows either carry-g-wheel to lift the rake-teeth independently of the other, which enables the ke to be discharged when turning round without causing the wheels to skid.

ig. 34.—*Section of Messrs. Nicholson and Son's Self-acting Horse-rake, No.* 1037.



The adjustment for regulating the height of the teeth from the ground is ade by raising or lowering the bar N N, shown in two positions, by the rew P. This gives a rise of $1\frac{1}{2}$ inch above the ground, and a fall of $1\frac{1}{2}$ inch to it, as shown by the dotted and plain lines of the tooth A. The bar N N divided into two at the centre of the rake, the ends of each section being ted with adjusting screws, so that the centre teeth of the rake may be wered whilst the end ones are raised, or *vice versâ*, and thus regulated to e inequality of the ground to be raked.

Another adjustment for altering the pitch or angle of the teeth with t ground is made at o by means of a pair of serrated discs.

The carrying-wheels of this rake are 48 inches in diameter, the spok and tires are of wrought iron; the spokes are half-round section-bent, as shov in the drawing, to form half of one spoke and the inner part of the rim of t wheel in one piece. These teeth, as in the other rakes by these makers, wo in couples.

Fig. 35.—*Trussing Arrangement of Messrs. Nicholson and Son's Self-acting Horse-rake, No.* 1037.

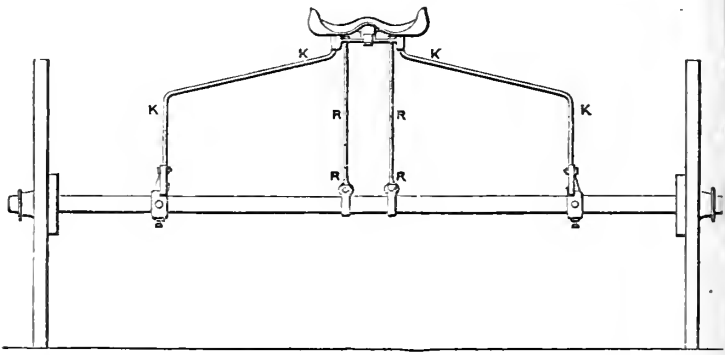


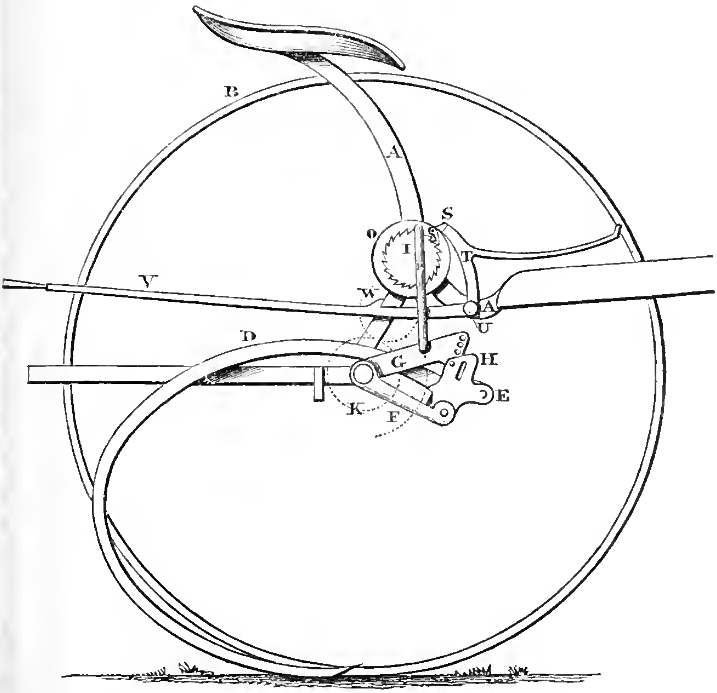
Fig. 35 illustrates the same makers' plan of trussing the axle, which, in great measure, obviates the objection to applying a seat, namely, the liabilit of the axle to become deflected by the weight of the driver being placed onl upon the middle part of the axle, and thus causing disarrangement in variou parts. R shows the truss-rods; K the seat-irons. It will be noticed tha both these are made to clasp the axle by clips, and are held firm by double se screws.

The Second Prize was given to No. 2774, manufactured b Haughton and Thompson. It has a very simple arrangemen for self-action, but the Judges did not consider the shape o the tooth so good as in the First Prize rake, neither was its per formance so satisfactory.

Haughton and Thompson's Self-acting Horse-rake, No. 2774.—The accom panying sketch represents the self-acting horse-rake, which took the Secon Prize, by Messrs. Haughton and Thompson. It is 9 feet wide. A is the fram of the rake and the support of the driver's-seat; B the travelling-wheel o wrought iron, 4 feet high; D the tooth, showing the particular shape, made o steel, and working upon the pivot E. The spur-wheel K is fastened near th centre of the revolving axle, geared into an intermediate wheel, W, which als gears in a third wheel, O, combined with the ratchet, which is partly covere by a hollow crank-disc, I, within which the pawl works, and partly overlap the ratchet-wheel. P is a connecting-rod coupling the disc O with the rocking frame of the rake G F H. In working the rake, the pressure of the foot from the person, when riding, upon the stirrup T, or, when walking, upon the back-lever V, by hand, vibrating on the stud U, engages the pawl with the ratchet

as shown at S, and through the medium of the connecting-rod, the rocking-frame is sufficiently acted upon to deliver the load, whilst the continuation of the revolution of the crank-disc brings the connecting-rod past the centre, and the teeth fall by their own gravity. There is a good arrangement for adjusting the teeth at various heights from and in a line with the ground by means of altering the position of the parts in the rocking-frame, shown by the holes in part, G. At the point W is a catch on the hand-lever, to disconnect the pawl from the crank, and keep the teeth elevated for travelling. The dotted lines at F show the extreme range of the rocking-frame.

Fig. 36.—*Section of Messrs. Haughton and Thompson's Self-acting Horse-rake, No. 2774.*



It will be noticed that both travelling-wheels are fixed on the main axle in this rake, so that more or less skidding must take place in turning. The axle with the gearing being always revolving, there is also danger of winding the hay round it when working it quite full.

Class V.—Horse-Rakes, not Self-Acting.

These machines were tried in the same manner and by the same Judges as the self-acting rakes, on the 7th July, with the alteration of the points of merit as under :—

1. Mechanical construction and workmanship, with soundness and quality of materials	250
2. Simplicity and lightness, combined with strength	100
3. Shape and capacity of rake teeth, with their mode of attachment..	100
4. Mode of adjusting teeth to suit various kinds of work ..	100
5. Perfection of work done	200
6. Price	50
	800

Nineteen machines came to trial, manufactured by 11 makers. The Judges reported that the only rakes which really worked efficiently were those manufactured by Nicholson and Son, and they believe they cannot speak too highly of them. They showed none of that nasty scratching action which many other machines had, but they glided nicely under the hay, more upon the heel of the foot than the toe, collected the hay without any disposition to roll, and delivered the load freely. The Judges, therefore, gave them the following awards :—

First Prize of 15*l*., to W. N. Nicholson and Son (1034), of Newark-on-Trent.

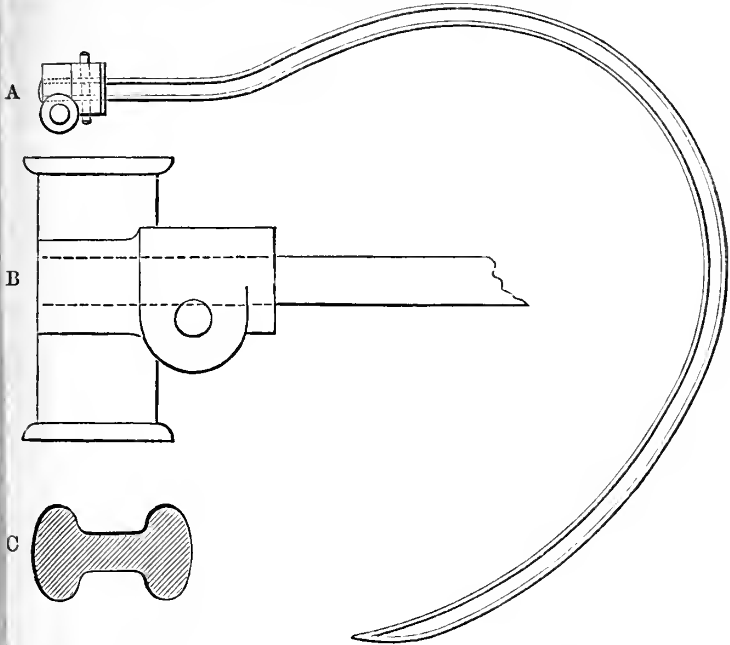
Second Prize of 10*l*., to W. N. Nicholson and Son (1033), of Newark-on-Trent.

Highly Commended, W. N. Nicholson and Son (1035), of Newark-on-Trent.

Nicholson's Horse-rake, not Self-acting, No. 1034.—It is not necessary to give a full drawing of so well-known an implement as a Horse-rake, as so many of them vary but little in general appearance. It is, however, important to allude to a few particulars in the First-Prize Implement.

Fig. 37 A represents the exact shape of the tooth, of which there are twenty-eight, made of English spring-steel, termed double-headed; a full-sized section of a tooth is given in Fig. 37 C, and a plan of the hand in Fig. 37 B. This hand, or part by which the rake-head is attached to the rod by which the teeth are drawn, is a more important part in a rake than might at first sight appear, as it frequently happens that a tooth becomes loose, and consequently two of them rake nearly in the same line, and leave too great a space between the next two. The hand is of cast iron, and ought to be of sound material, to allow the pin, which is machine-made and slightly tapered, to be driven very tightly through it, closely filling up a groove made in that part of the tooth, and shown in Fig. 37 A by dotted lines. The length of the tooth, which thus becomes rigid by the pin being well driven into the hand, tends to prevent too much play. The teeth in this rake work in couples, on the same principle as the self-acting rake-teeth by the same makers. All the teeth upon the horse-rakes by these makers are either partially or wholly coupled.

Fig. 37.—*Illustrations of the working parts of Messrs. Nicholson and Son's Horse-rake, not Self-acting, No.* 1034.



A. Side view of a Tooth. B. Plan of Hand.
C. Section of Tooth.

Class VI.—The Society offered as a prize for the best system of lrying hay in wet weather, sufficiently economical for practical ɔurposes, the large Gold Medal; for the second best, the large Silver Medal; under the following conditions:—"The drying powers of an apparatus will be ascertained by noting the time equired for the treatment of a given weight of green hay, and he weight of moisture removed from it during treatment. For conomy, these results will be further compared with the con- umption of fuel or power required for effecting the work." This offer failed to produce any entry.

Special Prizes.—Class A.

In reference to the prize offered at Bedford last year "for he best appliance or Guard to a Drum of a Threshing-Machine or preventing accidents to the people employed," the Judges vithheld the prize, upon the ground that none of the guards

were sufficiently simple and effective. They recommended that two prizes should be offered this year, one for a combined guard and feeder, the other for a guard; and the Society acted upon this suggestion. It may not be out of place to state here, that farmers generally, taking a broad and practical view of this matter, are not convinced that either guards or self-feeders are a necessity in this country. It is contended that accidents, except from the most gross carelessness, are of very rare occurrence, considering the number of machines working; and it must not be forgotten that with a powerful machine like a threshing-machine, even with the best guard, accidents cannot be altogether avoided; and with less care, they may even be aggravated.

If these guards take more power, add to the expense and complication, and are liable to get out of order, or are an obstruction to the work, they cannot be expected to find favour, nor to be long tolerated by the farmer who uses his own machine, or by the machinist who contracts to do this kind of work to a large extent in the country.

The prizes offered in Class A were:—

For the best Guard or appliance to the Drum of a Threshing-Machine for preventing accidents to the people employed	£ 20
For the second best	10

The Judges appointed to try these appliances were Mr. Sanday, Ratcliffe-on-Trent, Nottingham; Mr. Chambers, Colkirk Hall, Fakenham, Norfolk; Mr. Lake, Edgeworthy, Morchard, Devon.

The usual printed instructions were given to them, and the Table of points of merit was prepared as follows:—

1. Efficiency and simplicity	300
2. Non-interference with the quantity and quality of work done	300
3. The mode of adjustment	100
4. Price	300
	1000

These points were taken by the Judges separately, and compared at the conclusion of each trial; and the numbers were awarded to each exhibitor collectively. It will be noticed that the price was considered of great importance in a simple guard; 16 of these appliances, out of 17 that had been entered, were brought for inspection.

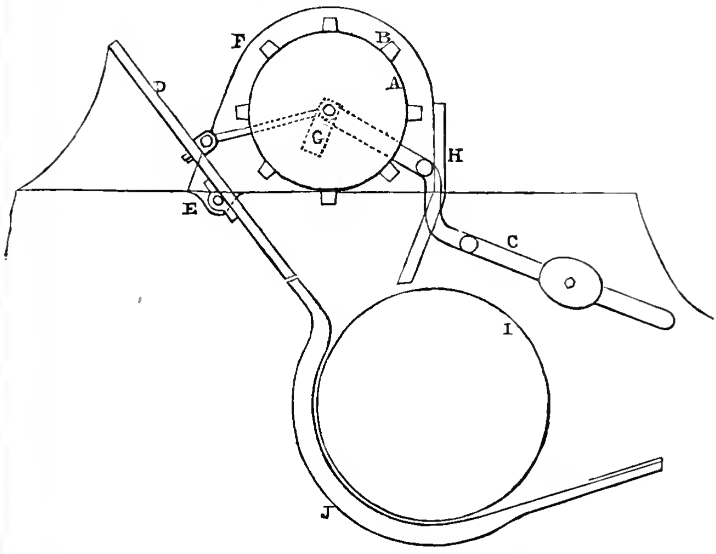
Wheat in the sheaf was provided by the Society; and the several threshing-machines having these attachments, which required a trial, were drawn under a temporary shed, and thoroughly tried in every practical manner, the power being

tested by the Society's dynamometer, under the superintendence of Mr. Anderson. A summary of the results of these Trials is given in Table VI., facing page 670.

The Judges considered that the price, 7*l.* 10*s.*, of No. 3813, by J. P. Fison, to which they gave the First Prize, was high for a guard; but it was far superior to any of the others, and although the revolving drum may be said to assist in the operation of feeding, yet there was no saving in the number of hands. It evidently took very little power to drive it, but this was not tested.

Fison's Drum-Guard, No. 3813.—This appliance may be shortly described: A represents a revolving cylinder, having a wood frame cased with sheet-iron, driven by a two-inch belt from the shaker-spindle, making 100 revolutions per minute, and covering the full width of the mouth of the machine; it is supported at either end by two balanced levers, C, connected with the swinging feed-board D, hung on pivots E. B shows eight bevelled wood projections, 1 × 1½ inch, screwed upon the cylinder.

Fig. 38.—*Section of Mr. J. P. Fison's Drum-Guard, No.* 3813.



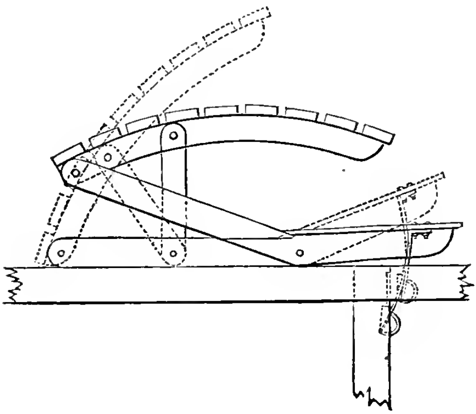
The spindle of the cylinder rests in moveable dies, in slotted iron brackets, G, bolted to the framework of the threshing-machine, and allows an extreme play up and down of 3½ inches. When compressed down either by a person slipping upon the guard, or by an extreme weight of corn upon it, the belt becomes slack, and the cylinder stops revolving. The same thing occurs when the feed-board is over-weighted; or an untied sheaf falling upon the cylinder causes a jam, and it ceases to act. When removed, the cylinder adjusts itself by rising into position by means of the lever C, and brings the belt into action.

The opening for the feed in actual work is $3\frac{1}{4}$ inches; and although this may appear narrow, it was found that the wood projections upon the cylinder sufficiently assisted, so as to draw in the feed. F shows a cast-iron bracket at either end of the guard; H is a check-board; I represents the threshing-drum; J the concave. This appliance can be added to any threshing-machine by provision being made for running the belt at the proper speed. The pulley upon the guard can be fitted to either side, as may be most convenient to an old machine; but it would be the best upon the opposite side from that at which it is usually fed.

The Second Prize was awarded to No. 708, by Tasker and Sons, price 2*l.* 10*s.*, which was a simple arrangement, but inferior in the more essential points, as a guard, to the First-Prize appliance.

Tasker and Sons' Drum-guard, No. 708.—This appliance, which took Second Prize, is a very simple attachment, requiring no belt-pulley or motive-power whatever. It consists of a wooden hood, about one-sixth of a circle, fixed to a frame resting upon the front part of the machine, and acted upon by a wood lever attached to the feed-board; a wood link, which is attached to the frame of the detachable guard, strengthens and steadies the hood. In the feeder-box is an iron spring acting in a slot, so that when the hood is down to ensure safety it cannot be released without lifting up the spring. A sheaf, or any greater weight, falling upon the back part of the hood will at once close it. The opening space for the feed when at work is 1 foot 4 inches. The dotted lines in the figure show the guard as open, and the solid lines show it as closed. The price is 2*l.* 10*s.*, and it can readily be applied to any machine.

Fig. 39.—*Section of Messrs. Tasker and Sons' Drum-guard, No.* 708.



Awards.

First Prize of 20*l.*, to J. P. Fison (3813), of Teversham Works, Cambridge, for Threshing-Machine Guard.

Second Prize of 10*l.*, to W. Tasker and Sons (708), of Andover, for a Threshing-Machine Guard.

It is not necessary to give any illustration of the remaining drum-guards; two or three exhibited by Clayton and Shuttleworth were simple in their arrangement and application, but only partial guards. Some of the others were scarcely any guard, and somewhat of a hindrance to the feeder.

TABLE VI.—SUMMARY OF RESULTS OF TRIALS OF GUARDS OR APPLIANCES TO THE DRUMS OF THRESHING MACHINES FOR PREVENTING ACCIDENTS TO THE PEOPLE EMPLOYED (SPECIAL CLASS A).

There were 17 Entries for Trial in this Class; of these the following 12 were carefully Inspected and Worked.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
			CONSTRUCTION.						POINTS OF MERIT.					
NAME OF EXHIBITOR.	Catalogue Number.	Price.	Length of Drum.	Width of Opening through which Sheaf-Corn is fed in Inches.	Depth of Feed-Box below Platform in Inches.	Height of Feed-Board above Platform in Inches.	Distance from Periphery of Drum to Edge of Feed-Board in Inches.	REMARKS ON CONSTRUCTION AND TRIAL.	Efficiency and Simplicity.	Non-interference with the Quantity and Quality of Work done.	The Mode of Adjustment.	Price.	Totals.	AWARDS.
									PERFECTION BEING					
									300.	300.	100.	300.	1000.	
		£ s. d.	Ft. In.											
Hornsby and Sons	584	2 2 0	4 6	6½ to 11	9¼	13½	1½	Feed-board works on hinges to close over drum, in working position rests against stops 22 inches off bottom of feed-board. Feeder falling is supposed to close guard. A bad feed-board, and inefficient guard.	150	150	80	250	630	
Marshall, Sons, and Co. ..	3877	2 0 0	4 6	19	19½	2	5½	Guard held in position by spring communicating with a lever to cover at back of feed-box. Feeder getting out of box presses down spring with his foot and lets go guard. Works stiffly, and is no protection to man feeding.	100	200	25	100	425	
Nalder and Nalder	3816	0 15 0 to old machine.	4 6	11	23	3	1	Box-guard fitted for working on both sides of drum. Feed-box 22 inches deep, feed-box over shakers 11 inches deep. Feed-board closes over drum for cleaning up.	50	200	80	100	430	
Clayton and Shuttleworth ..	3178	Free.	4 6	6½ to 19	9	20	33	Not a self-acting guard, but casing-board and feed-board adjustable by means of thumb-screws, so as to adjust size of feed opening, or close it if desired.	180	120	80	200	580	
Tasker and Sons	708	2 10 0	5 0	14½	24	9	18	Feed-board and circular top guard connected by two wooden links, extra pressure on feed-board brings guard down. Very simple, and works well; but normal opening very wide; easily adapted to ordinary machines	250	250	100	250	850	Second Prize.
Clayton and Shuttleworth ..	3479	Free.	4 6	5	19	9	10	Feed-board serves as guard, held in position by catch, pressure on feed-board lets go catch and brings guard down. Machine fed over centre of drum.	150	150	70	200	570	
Wilkinson, W.	1719	2 15 0	4 0	23	19	9	2½	Box-guard with moveable side boards to keep loose corn from feed-box. Feeder too close to drum, and in danger of losing his hands (*see* column 8). Flap-door in back of guard for sweeping up.	100	150	50	200	500	
Fison, J. P.	3813	7 10 0	4 6	18	4¼	9½	5	Revolving roller over mouth of drum driven off pulley on shaker shaft, making 100 revolutions per minute, roller bearings work in slots with 3 inches travel, held in position by levers and weights attached. Feed-board connected to ends of lever. Undue pressure on feed-board lowers roller and stops it by loosening belt, and at same time closes feed opening.	300	300	80	200	880	First Prize.
Ruston, Proctor, and Co. ..	3527	3 10 0	4 6	9½	19	17	6	Box-guard covers drum, feed from level of platform in any position. Feed-board connected to guard by links. Guard held up in position by catch. Weight on feed-board releases guard and covers up drum.	180	150	70	200	600	
Clayton and Shuttleworth ..	3180	Free.	4 6	12½	19	4	11½	A double arrangement of guard. A circular casing over drum is closed easily, by pressure from above or behind, such as a person falling on it. The feed opening closes directly the feeder gets out of his box, the bottom of his box being counterbalanced, and rising when his weight is removed.	150	250	50	200	650	
Marshall, Sons, and Co. ..	3878	3 10 0	4 6	6½ to 19	17	9½	4¾	The feed opening is closed whenever pressure is brought to bear on a rail surrounding feeder's box. The feeder necessarily closes it on leaving his box. Adjustments troublesome, and likely to get out of order.	150	150	60	150	510	
Wilkinson, W.	1720	2 15 0	4 0	13 to 19	18	7¼	2½	A crude arrangement. Pressure on drum casing will reduce feed opening by about 5 inches, and closes ends of same.	100	100	50	200	450	

To face page 670.

Table VII.—Summary of Results of Trials of Combined Guards and Feeders to the Drums of Threshing Machines (Special Class B).

There were 11 Entries in this Class; of these, 10 were submitted to careful Examination and Trials with the Rotary Dynamometer with and without Sheaf Corn.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
							DYNAMOMETER TRIALS.									POINTS OF MERIT.						
							Friction of Machine running light, and doing no Work.			Trial with 100 Sheaves of Corn weighing, as per an Average, 666 lbs.												
Name of Exhibitor.	Catalogue Number.	Price.	Length of Drum.	Width of Opening for Feed in Inches.	Description.	Condition of Machine.	Speed of Belt in Feet per Minute.	Actual Foot-lbs. of Work used in Driving Machine per Minute.	Horse-Power required to drive Machine empty at assumed uniform belt-speed of 2000 feet per Minute.	Time occupied in Minutes and Seconds.	Speed of Driving-Belt in Feet per Minute.	Total Foot-lbs. of Work done.	Horse-Power at 33,000 Foot-lbs. per Minute.	Foot-lbs. of Work done per lb. of Sheaf Corn, or Height in Feet representing Work done.	Economy represented by lbs. of Coal used per hundred such Sheaves in an average Engine at 7 lbs. Coal per useful Horse-Power per Hour.	Mechanical Construction and Workmanship, with Soundness and Quality of Materials.	Efficiency as a Feeder; Simplicity and Ease of Management.	Capabilities of Feeder to take in all kinds of Crops.	Efficiency as a Guard, without interfering with the Quantity and Quality of Work done.	Price.	Totals.	Awards.
																Perfection being 200.	300.	150.	300.	50.	1000.	
		£	Ft. In.																			
Nalder and Nalder	3845	20	4 6	7¾ to 12¾	Wilder's patent feeders, and a cage of horizontal iron bars over feed-opening. A person falling on this cage would close feed-opening and throw off belt.	Without feeder. Feeder in gear.	2190 2190	227,000 257,200	6·29 7·11	4 11 7 15	2106 2116	1,369,000 2,171,500	9·9 9·1	2053 3256	4·84 7·67	150	100	50	250	30	580	
Marshall, Sons, and Co. ..	3879	15	4 6	4 to 13¼	The self-feeder consists of travelling-rakes attached to endless bands at sides of feed-opening, assisted by oscillating tines above the opening. Any undue pressure on feed-board throws off belt.	Without feeder. Feeder in gear.	2160 2225	166,500 172,250	4·67 4·69	3 17 4 1	2059 2051	1,123,500 1,217,000	10·3 9·2	1685 1825	3·95 4·30	200	100	50	100	40	490	
Marshall, Sons, and Co. ..	3880	20	5 0	5¾ to 8½	A vibrating board in feed-opening constitutes the self-feeder. Pressure on a rail round edge of feed-board throws off belt.	Without feeder. Feeder in gear.	2125 2100	196,750 219,700	5·61 6·33	4 22 3 18	2049 1994	1,462,000 1,192,500	10·1 10·9	2193 1788	5·16 4·21	150	250	140	250	30	820	Second Prize.
Hornsby and Sons	585	20	4 6	3½ to 5	Self-feeding apparatus, consisting of a revolving spiked cylinder, with fixed springs above it, to regulate the quantity of feed. Enclosed in a casing without special guard.	Without feeder. Feeder in gear.	2250 2190	216,000 196,000	5·81 5·41	2 47 2 59	1986 2014	930,500 1,113,000	10·1 11·6	1395 1714	3·28 4·03	200	180	150	100	30	660	
Tasker, W., and Sons ..	707	10	4 6	6 to 8½	Two drums, the one cylindrical, the other square in section, and both furnished with teeth, revolve one above the other in opposite directions; some fixed teeth opposite regulate the amount of feed. Guard same as 708 in Class A.	Without feeder. Feeder in gear.	2090 2130	193,500 216,170	5·61 6·15	4 9 4 44	2026 2011	1,409,500 1,571,000	10·3 10·0	2113 2356	4·94 5·55	150	50	25	200	25	450	
Fison, J. P.	3814	20	4 6	3½ to 4½	The self-feeder consists of six endless belts, with wooden projections on them, and a revolving drum above them. Cased in, but no special guard.	Without feeder. Feeder in gear.	2050 2140	247,200 219,000	7·31 6·20	4 30 2 55	2002 1988	1,882,000 931,500	12·7 8·6	2823 1246	6·65 2·93	100	100	50	150	25	425	
Clayton and Shuttleworth	3481	20	4 6	3½ to 5	Wilder's patent-feeder, with boards between shakers; these intermediate boards project slightly above the shakers in places, and undue pressure on any one of them throws off belt. Feed adjusted by oscillating tines above feeder.	Without feeder. Feeder in gear.	2150 2170	204,000 226,500	5·75 6·32	3 4 2 42	1998 2077	1,115,500 1,065,000	11·3 11·9	1767 1597	4·04 3·76	200	270	140	280	40	930	First Prize.
Robey and Co.	3656	15	5 0	3 to 4¾	Shaking feed-board with slots, through which oscillating tines work, like long tiger claws, drawing down the corn. The rate of feed is regulated by fixed tines on opposite side of opening. No special guard.	Without feeder. Feeder in gear.	2150 2180	220,250 249,500	6·46 6·93	3 37 2 36	2087 2046	1,278,000 955,000	10·7 11·1	1912 1432	4·50 3·37	200	270	140	50	30	690	
Ruston, Proctor, and Co. ..	3526	15	5 0	7¼	The self-feeder consists of three shafts, with spikes on them. Undue pressure on the feed-board releases a spring, which puts driving clutch out of gear. Adjustment of spring delicate.	Without feeder. Feeder in gear.	1710 2080	230,200 237,750	8·15 6·92	2 26 2 40	1261 2010	980,000 996,000	12·2 11·3	1470 1494	3·46 3·52	200	150	70	100	25	545	
Tasker, W., and Sons ..	709	10*	5 0	5 to 8½	Feeder and guard same as 707. Fitted with patent band-cutter, consisting of a mowing-machine knife and fingers in back of feed opening.	Without feeder. Feeder in gear.	2070 2120	225,200 239,500	6·59 6·84	4 16 5 17	2029 2076	1,512,000 1,635,500	10·7 9·4	2268 2452	5·34 5·77	150	100	25	200	25	500	

To face page 671.

* Band Cutter, £2 10s. extra.

Special Prizes.—Class B.

The following were the prizes offered in this class:—

	£
For the best combined Guard and Feeder to the Drum of a Threshing-Machine	20
For the second best	10

The same three gentlemen officiated as in Class A. It will be seen that price was not considered by the Society of so much importance in this class as in the previous one. The following Table of points was prepared for this class:—

1. Mechanical construction and workmanship, with soundness and quality of materials	200
2. Efficiency as a feeder, simplicity and ease of management	300
3. Capabilities of feeder to take in all kinds of crops	150
4. Efficiency as a guard, without interfering with the quantity and quality of work done	300
5. Price	50
	1000

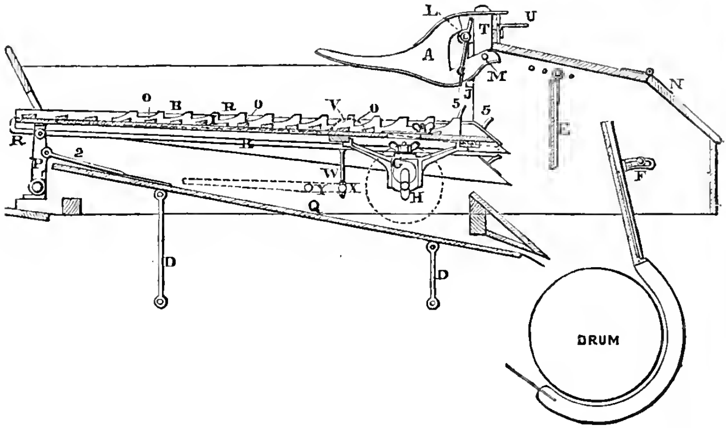
The object in view with the Judges appears to have been, that a self-feeder should be a labour-saving machine, and displace, at any rate, one man; and they had hoped that the operation of feeding would have been more regularly and efficiently performed. They did not, however, consider any of the appliances so efficient as an expert man-feeder.

The liability to derangement of every additional part to an already complicated machine like a threshing-machine is calculated to cause loss of time; and the Judges did not view them with any great amount of favour.

However, as will be seen by the annexed Table (VII.), which contains a summary of the results of the Trials, the Judges considered No. 3481, by Clayton and Shuttleworth, price 20*l.*, far superior to any of the others, and awarded it the First Prize.

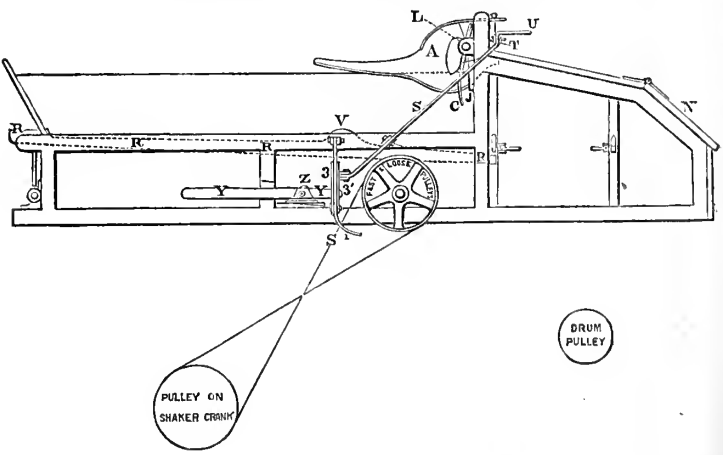
Messrs. Clayton and Shuttleworth's Combined Guard and Feeder, No. 3481.—This apparatus works on a similar principle to the straw-shaker of a threshing-machine. A series of five vibrating boards, B (Fig. 40), armed with ratchet-teeth, shown by 1 and 5, are worked by a five-throw crank, H, placed underneath, and would feed the corn into the drum-mouth as fast as it was thrown on to these boards, were it not for a set of seven vibrating teeth, C (Figs. 40 and 41), which open out the sheaves, and only permit as much to pass as is allowed by the adjustment of the teeth on the shaft L (Figs. 40 and 41), or of the shaft itself in its bearings J, which are capable of being moved up or down on the upright frame-post. The shaft L receives its motion from a crank-pin in a fly-wheel on the far side of the feeder crank-shaft H, not shown in the drawing. The teeth C make 180 double strokes per minute. The guard A is adjustable on the pivot M; its object partly is to keep the corn down where the points of the teeth C can operate with the best effect. E is a swinging board for guiding the corn down towards the drum-mouth after it leaves the feeders. The fixed board F answers the same purpose; both E and F are adjustable in position, as shown in Fig. 40. The board F also serves as a feed-

Fig. 40.—*Longitudinal Section of Messrs. Clayton and Shuttleworth's Combined Guard and Feeder, No.* 3481.



board, in case of feeding the machine by hand. The bolts which hold it at each side are then removed, and it can be thrown back, and the door N (Figs. 40 and 41) opened to admit the corn. The feeder-boards, B, are fitted with cross laths, O, on each side of the ratchet teeth, I, for the purpose of propelling towards the drum any grains of corn which shake out of the ears. Such of these loose grains as escape between the feeder-boards B, and the safety-boards R (Figs. 40 and 41), are caught and conveyed to the drum by the inclined vibrating board Q, which is supported on the links D, and actuated

Fig. 41.—*External Gearing of Messrs. Clayton and Shuttleworth's Combined Guard and Feeder, No.* 3481.



by connecting-rods, shown by 2, from the links P, carrying the ends of the feed-boards B.

The safety-gear is fitted with the lever S (Fig. 41), which is jointed to the strap-fork S I. This lever terminates at its upper end in the handle U, being connected with the horizontal sliding-bar T (Figs. 40 and 41), which is furnished with another handle, U (Fig. 40), at the opposite end of the machine. This arrangement gives ready facility for anyone to throw the driving-strap on the loose pulley, and stop the feed whenever required, particularly if anyone fell on the feed-boards B, and had not the presence of mind to roll himself off.

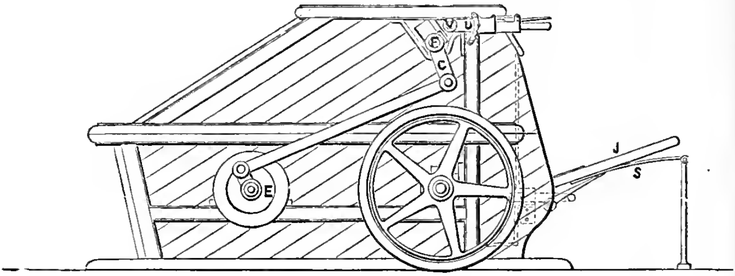
This machine, to which the First Prize was awarded, is arranged in such a manner that any body or substance exceeding in weight a sheaf of corn, will, in passing over the feed-boards B, cause the apparatus to stop immediately and automatically. This result is produced by the body depressing the safety-boards R (set edgeways between the feeder-boards B) in passing over the semicircular parts, V (Figs. 40 and 41), which project above the feed-boards B, at two points in each revolution of the crank-shaft, viz., when the cranks are passing the horizontal centres.

Each safety-board R, being connected by a rod W (Fig. 40) with the cross-bar X, which is jointed at each side of the machine to levers Y (Figs. 40 and 41), keyed to a shaft Z, common to both levers Y, it follows that when any one of the safety-boards R is pressed down, all the others will be simultaneously depressed. One end of the cross-bar X is curved upwards, and jointed to the strap-fork S I by a pair of links, 3, 3′ (Fig. 41), whereby the depression of X pushes the driving-strap on to the loose pulley and stops the feeding. The levers Y are lengthened beyond the shaft Z, to receive weights, if required, to counterbalance the safety-boards R. The guard A projects horizontally over the feeder, as an additional means of safety. A large number of this apparatus have been fitted to old machines, originally made to feed by hand. The practical efficiency of this machine was tested in the presence of the Judges by a man actually falling upon it.

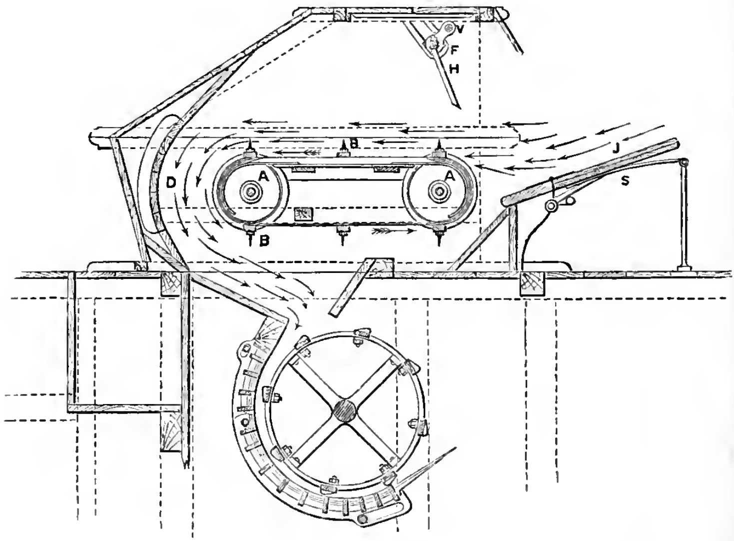
Marshall's Self-feeder and Drum-guard, No. 3880.—This attachment to a threshing-machine was awarded the Second Prize. It consists of two endless three-inch leather bands working over turned pulleys, A A (Fig. 43), at each side of the feed-opening, to which are attached wooden cross-bars, B B. Short iron tines, $2\frac{1}{4}$ inches long, are placed at intervals on the cross-bars in such a position as to alternate with each other. These cross-bars are arranged to travel in the direction of the arrows. At a convenient height above the platform is a series of ten progs, H, to which an oscillating motion is given by means of the shaft F F (Figs. 42 and 43), the crank C, and pulley E. The distance of this shaft, and consequently the height of the tines above the platform, can be adjusted by means of the combination U V (Fig. 42), the shaft being caused to move up or down in slotted brackets which carry the bearings. This arrangement is introduced to adapt the apparatus for taking in both sheaf and loose corn, and regulating the distribution to the drum. For bean-threshing the board D takes out. Sliding-carriages are applied to one of the belt-spindles, to enable the endless bands to be readily adjusted. As a further safeguard against the possibility of accident, two endless chains are affixed over the belts and secured to each cross-bar, so that, in the event of either of the bands giving way, the cross-bars are held in position, and prevented from coming in contact with the threshing-drum.

The means adopted for automatically stopping the machine are very simple. Motion to the feeding apparatus is got from the shaker-shaft by means of a belt, fast and loose pulleys being employed. A lever is used for throwing the arrangement in and out of motion. The receiving-board J (Figs. 42 and 43) is hinged, and is carried on a spring, S; so that if any pressure is thrown upon it, as in the case of an attendant falling, the board yields, and the apparatus is put out of gear.

Figs. 42 and 43.—*Side Elevation and Longitudinal Section of Messrs. Marshall and Sons' Self-feeder and Drum-guard, No.* 3880.



SIDE ELEVATION



LONGITUDINAL SECTION

A drawing of Tasker and Sons' appliance, No. 707, is given to show the application of a knife to cut the bands of the sheaves. It was thought by the Judges to be a move in the right direction, as a saving of labour, and probably will become a valuable attachment when it is more perfected. The feeder itself had nothing to recommend it.

Messrs. Tasker and Sons' Combined Guard and Feeder, No. 707.—Figs. 44 and 45 are a plan and section showing the knife-arrangement for cutting the bands of sheaves, the price of which is 2*l.* 10*s.* extra. A A is a pair of ten-inch diameter rollers, the bottom one being square, making forty revo-

lutions per minute; B shows 12 spikes, riveted into each roller in four rows, at an angle of 45°. C C are two rows of fixed iron spikes, 9 in each row, screwed into iron rails on the back of a loose frame F, adjustable in slots, so as to vary the room when required. The rollers are driven by gearing, shown in Fig. 44, by a strap from the shaker-spindles; from the end of the top-roller spindle a bevelled-wheel drives a bevelled-pinion and connecting-rod, giving motion to the knife K (Fig. 44), making eighty strokes per minute. It will be seen that the feed-board H is tilting, so that when pressed down and the hood is closed, there is an opening at the front to allow for sweeping down any loose corn into the feeders. The knife K effectually cuts the bands of the sheaves.

Fig. 44.—*Plan of Messrs. Tasker and Sons' Combined Guard and Feeder, No.* 707.

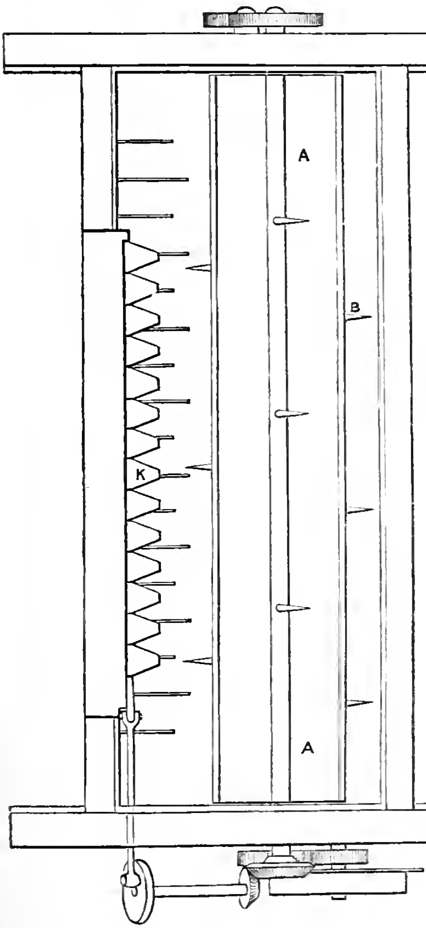
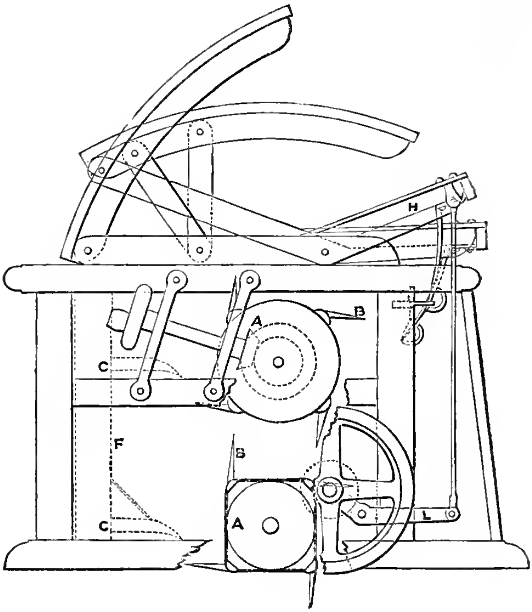


Fig. 45.—*Section of Messrs. Tasker and Sons' Combined Guard and Feeder, No.* 707.



It may also be useful to give an illustration of No. 3656, by Robey and Co., as a clever and ingenious attachment. The Judges considered that it worked well; and it will be seen by the Table facing page 671, that less power was expended when in work with the feeder than without it; but they did not consider it combined the essentials of a guard.

Robey and Co.'s Self-feeder, No. 3656.—This feeder is a clever arrangement, which commanded the particular attention of the Judges, and, as will be seen by the Table, worked very satisfactorily as regards power; but it had small claims as a guard. It may be explained by the accompanying illustrations. A is the drum, B the concave of the threshing-machine. C C (Figs. 46 and 47) represent the fork-shaft and forks receiving a motion backwards and forwards from a crank-pin, D, on one arm of the shoe-pulley E; G is a shaking-board, on which is placed the crop to be threshed. This board has a motion up and down, which it gets from an eccentric, H H (Figs. 46 and 47), on either end of the shoe-shaft. The amount of motion which may be given to the shaking-board and forks can be regulated at will. A row of fixed forks, I, are placed on a fixed board, to prevent the feed going into the drum faster than required.

The angle of the driving-gear of the shaking-board, G, and the forks C, is so fixed that the board is lowered at the time the forks make a grab forward, and is raised as they come back, so that the forks return under cover.

Let it be imagined that the hopper is filled and the machinery at work. When the forks C protrude through the board G as it lowers itself, they take hold of a portion of the feed and carry it down to the drum, the bent-irons J J (Figs. 46 and 47) guiding it properly to the drum. The board G then rises, and the crop is held by the fixed forks I I, while the moving forks C return under cover of the shaking-board to make a fresh grab. They make about 200 grabs per minute.

Fig. 46.—*Section of Messrs. Robey and Co.'s Self-feeder, No.* 3656.

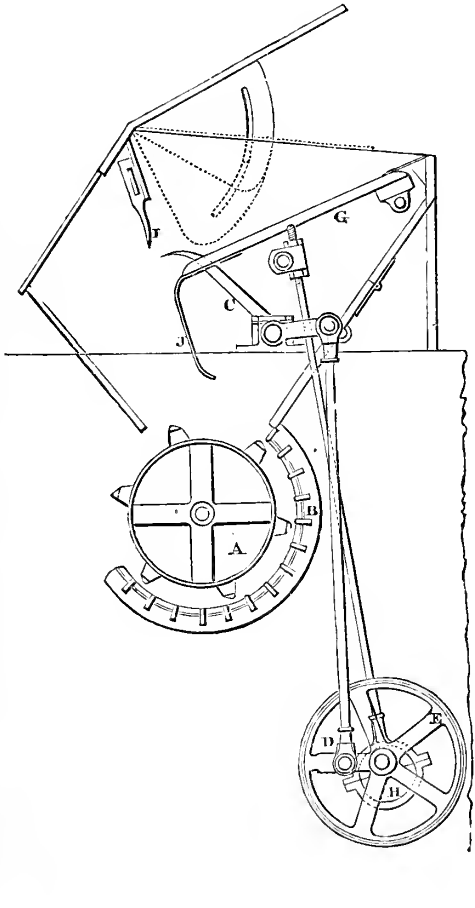
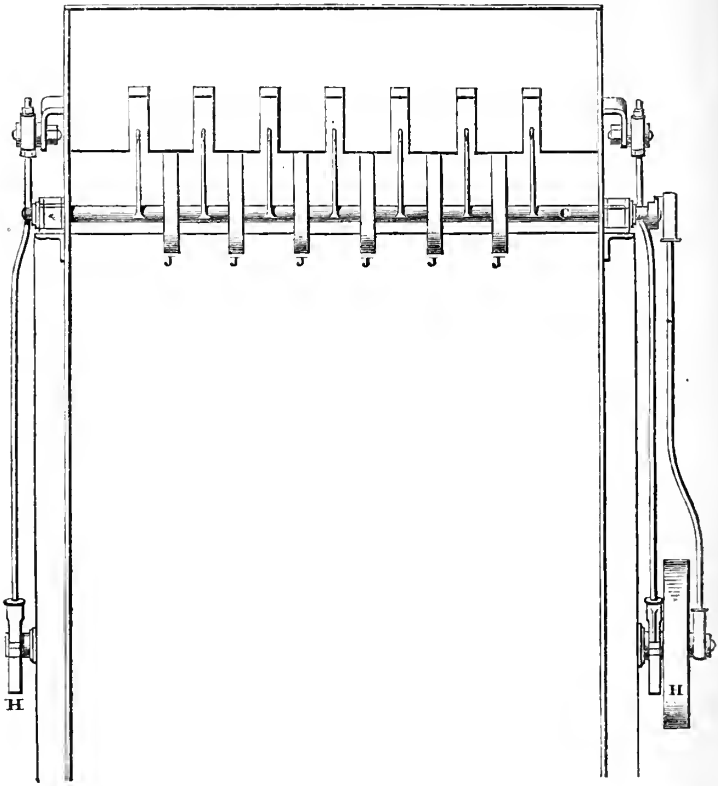


Fig. 47.—*Plan of Messrs. Robey and Co.'s Self-Feeder, No. 3656.*



Awards.

First Prize of 20*l.*, to Clayton and Shuttleworth (3841), of Lincoln, for a Combined Guard and Feeder.

Second Prize of 10*l.*, to Marshall, Sons, and Co. (3889), of Gainsborough, for a Combined Guard and Feeder.

Miscellaneous.

The Judges appointed in the Miscellaneous Class were the same as those engaged in the trials of Drum-guards and Feeders; but as most of their time had been taken up by those lengthy trials, the Judges of Hay-makers and Horse-rakes assisted in going through the 284 stands of implements. The following printed directions were given:—

Silver Medals.

1. The Judges are requested to observe, that in addition to the specified Prizes, there are Ten Silver Medals, which they have the power of awarding in case of sufficient merit.

2. These Medals cannot *in any case* be awarded to any implement included in the ordinary rotation, unless (1) it belongs to the classes for which prizes are offered at this Meeting, or (2) the principle on which the implement is constructed be entirely new, and the implement never before exhibited at any of the Society's Shows.

3. These Medals are specially intended as a mark of approval of any new principles of construction which the Judges may consider as *essential improvements;* subject always to the restriction contained in Rule 2.

4. The Judges are also empowered to make special awards of Medals for efficient modes of guarding or shielding Machinery, especially when worked by steam, from contact with persons immediately engaged in attending to it while at work.

5. No Medal shall in any case be awarded to any implement or miscellaneous article capable of trial until it has been subjected to such trial as the Stewards may direct.

6. No Medal shall be awarded by the Judges without the consent of the Stewards, and no Commendation of miscellaneous articles shall be made by the Judges.

Only a very few articles or implements were found worthy, in the opinion of the Judges, of a recommendation for these medals. The Miscellaneous Judges spent a long time in trying Page and Girling's Drop Drill, No. 2029, an implement requiring special attention. The great fault of this machine was that the dropping of the seed was not sufficiently regular. When the drill was doing close work, and going at a fair pace, the seed was so scattered as almost to form a continuous stream. The Judges were, however, fully aware of several valuable parts in the machine, especially that of the double-action coulter, although the trial was not sufficiently successful to justify them in recommending a medal.

The Miscellaneous Judges tried Messrs. Barford and Perkins' Campain's Anchor, No. 21, with Savage's recently patented improvements; they thought highly of it, and recommended a Silver Medal to be given to it.

A drawing of this implement in its original state was given in this Journal for 1871, page 515, so that the recent improvements only require our attention.

The rope is supposed to be travelling in the direction of the arrow. A A (Fig. 48) represents the main pulley, working upon a pin firmly fixed to the frame of the anchor. B is a ball of wood through which the rope passes, and which is prevented from going nearer to the plough or drag by a moveable clip, C, being fixed upon the rope at any required distance in advance of the plough. D represents a strong cast-iron shoe; and when the ball jams up against it, it acts upon the lever E, setting at liberty the

anchoring arrangement, as shown by Fig. 49, and allowing the anchor to run on the required distance, by releasing its claws.

Fig. 48.—*Plan of Campain's Anchor, with Savage's Improvement, No.* 21.

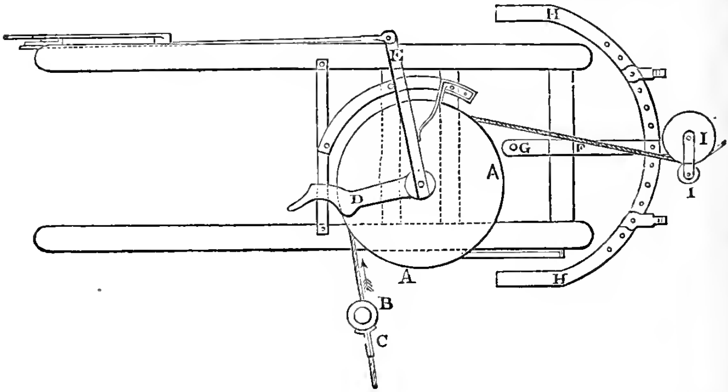
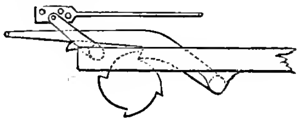


Fig. 49.—*Section of the Ratchet in connection with the claws of Campain's Anchor, No.* 21.



The steering arrangement, also new, is shown by Fig. 48, F being a strong iron lever 3 feet long, attached to and turning upon the centre bolt of the fore-carriage at G, riding upon the half-circular bar H H, which rests upon the extreme points of the axles. At the end of this lever are attached two pulleys, I I, between which the rope is guided in the direction in which it is intended to steer the anchor. This adjustment is altered by means of a bolt through the lever, and any of the holes shown in the half-circular bar, and thus an angular direction to the travel of the anchor may be given without the aid of any additional rope. The ball is fully at liberty to leave the shoe for the return journey—of course the same arrangement is required at the opposite end. It will be observed that one of the many advantages over the old system is that the slack rope is left in the track of the return journey, instead of being dragged sideways into the direct position by the strain of the tight rope at the opposite end causing the anchor to advance.

The Judges of Hay-makers tried Aspinwall's Potato Planter, No. 1293, in a piece of deepish cultivated loam. They found

it to work very fairly, and to deposit the seed very regularly, rarely missing the delivery of one potato, and in no case more than one, although the seed was of various sizes. They recommended that a Silver Medal be given to it.

Fig. 50.—*Section of Aspinwall's Potato-planter, No.* 1293.

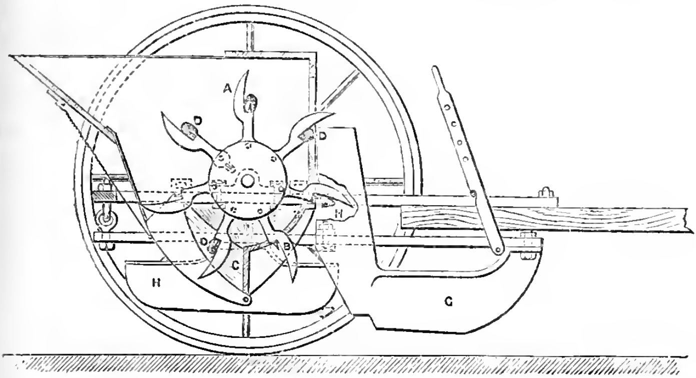
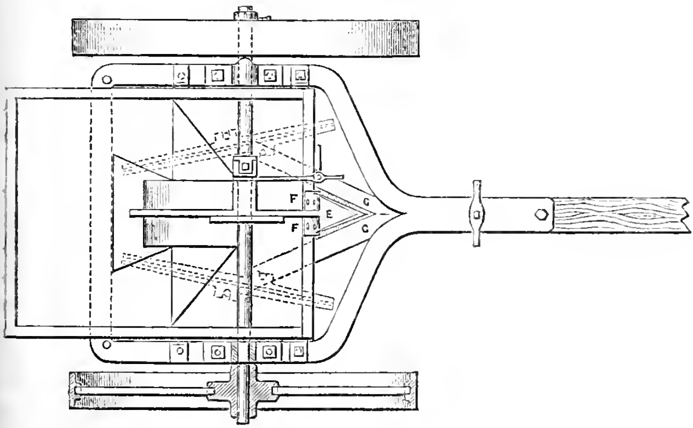


Fig. 51.—*Plan of Aspinwall's Potato-Planter, No.* 1293.



A, in Fig. 50, represents a radial arm, of which there are seven, attached to a disc keyed on the main revolving axle of the implement, near the top part of which a strong steel needle is fixed, shown as empty at B, Fig. 50.

Immediately behind this needle is a guard to prevent the potato being displaced. The needle, by passing through the lower part of the hopper C, Fig. 50, which contains the potatoes, becomes firmly fixed into one of them, as shown by D D, Fig. 50.

and is carried round to the point E, Fig. 51; at this point there is a pair of spring-roller jaws, F F, Fig. 51, which disconnects the potato from the needle; the tuber being liberated by these jaws, as shown at H, Fig. 50, drops into the furrow formed by the shares, G G, Figs. 50 and 51, the mould-boards, H, close the furrow and cover up the potato.

The neck of the arm then passes through a narrow opening between the jaws to pick up another potato. It will be seen by the drawing that the hopper is made contracted at the bottom, so as to assist in firmly fixing the potatoes upon the needles. The implement is small and compact, but being a new invention may be open to improvement.

The Royal Agricultural Society's engineers tested two steam-boilers with considerable care; the first was No. 3641, by Davey, Paxman, and Co. The Society is well acquainted with it, and it has earned for itself a good reputation in actual work. It is a 6-horse-power nominal vertical boiler, with their patent water-tubes and tube-valves, having about 100 feet of heating surface. As it has never before been tried by them for duty, the engineers thought it would be interesting and useful to the Society to prove its powers. The result turned out to be very high, viz., 11·26 lbs. of water at 212° Fahr., evaporated into steam at 212° per lb. of good Welsh coal. It was not, however, considered sufficiently new to be entitled to the Society's medal. The other, No. 3726, by K. W. Hedges and Co., was a 4-horse-power vertical multitubular boiler; but the trial was unsatisfactory, not so much from the shortcomings of the boiler, as from the way in which it was managed.

Brown and May's Spark Catcher, No. 3853, was tested, at considerable pains, and found to be very efficient. It consists of an annular pan round the top of the chimney, which is filled with water, forced up from the boiler by means of a pipe and cock. The top of the chimney and the inner half of the pan are covered by a shallow domed cover, which reflects sparks, as they rise, on to the surface of the water.

The objections to the apparatus are, that it entails another steam connection to the boiler, and a coupling which must be disconnected every time the chimney is lowered. The pan also must be cleansed periodically, and before steam is raised it can only be filled with water by hand.

These requirements rendered it probable that the apparatus, if fitted to an engine, would seldom be properly attended to in actual practice. It was also considered that few stackyard fires are caused by sparks flying from the chimneys of portable engines.

XXIV.—*Memorandum on the Adjustment of Dynamometers.* By Messrs. Eastons and Anderson, Consulting Engineers to the Society.

During the many years that the Royal Agricultural Society has used registering dynamometers, for testing the power required to work various implements, difficulties have from time to time arisen, in getting the instruments to record accurately and consistently with the laws which are supposed to govern their action. This has been even more evident in the communications that have reached us from foreign countries, and from other Societies for whom we have made dynamometers similar to those used by the Royal Agricultural Society.

The introduction at the Bedford and Taunton Implement Trials of the horse-dynamometer, the most complete and accurate instrument we have yet made, and which is fully described in the 'Journal,' Vol. X., 2nd Series, p. 680, induces us to offer a few remarks on the adjustment and use of dynamometers, and the mode of determining their co-efficients; and in doing so we must begin by stating how very much we are indebted to our Chief Engineer, Mr. W. E. Rich, for solving the difficulties connected with the use of these invaluable instruments, his great practical experience in the trial-fields, having given him a thorough insight into their peculiarities.

The registering apparatus, as is well known, consists of a flat disc, moved by a wheel, which measures the distance traversed; the number of revolutions made by the disc is, therefore, in proportion to the distance passed over by the instrument. Across the face of the disc, and exactly in the line of its diameter, a small integrating wheel, as it is called, traverses, the wheel being at right angles to the disc, and kept in close contact with it by a spring, and caused to revolve by the friction of its periphery against the face of the disc. This wheel actuates a counter, and is connected with the spring or springs through which the draught or driving-power passes, so that the wheel moves from the centre of the disc towards its periphery, as the draught-springs yield under the power applied: and as the circumference of a circle bears always a constant relation to its diameter, it follows that the further the wheel is from the centre of the revolving disc, the faster it will turn; but if the integrating wheel is adjusted so as to be exactly opposite the centre of the large disc when the springs are unloaded, its distance from the centre, and therefore, also, its number of revolutions per revolution of the large disc, will increase in direct proportion with the strain applied, and the revolutions of the large disc are

proportional to the distance traversed, therefore the revolutions of the integrating wheel must be proportional to the distance multiplied by the strain; in other words, the space passed over and the strain are multiplied together, and appear as figures on the integrating counter, which represent the work done in foot-pounds or any other units.

To arrive at the numerical value of the particular measure required, it is necessary to multiply the numbers appearing on the counter by a co-efficient, which will be different for different springs. To obtain these co-efficients, the instrument—being in perfect order, newly cleaned and oiled, every part working freely—is placed in its working position, the springs being unloaded, and the integrating wheel set exactly over the centre of the disc, so that turning the latter will produce no effect on the former. And here comes the first difficulty, namely, to determine when the springs are completely passive; for, when they are nearly free from strain, the smallest pressure will move them a little either way, where they will remain, unable to overcome the friction of the machine. An experienced operator with a small machine can find the zero-point readily by easing the springs backwards and forwards, and bringing them to rest by degrees; but in heavy machines the best plan is, by means of a pinch-bar, to press the springs over, first one way and then the other, marking the points to which they spontaneously return, and then adjusting the integrating wheel to the exact centre of the disc, when the springs are set half-way between the two points so found.

The integrating wheel being adjusted, and the counter set to zero, or its reading noted, a known weight is put upon the springs, either by means of a bell-crank lever, or by hanging the instrument up in a crane; in which latter case the weight of the draw-bar, and any other part that tends to affect the springs, including, generally, part of their own weight, must be ascertained, and considered added to the load. The measuring wheel is then turned round till it represents any distance, say 300 feet, passed over, after which the indications of the counter are noted. This should be repeated two or three times, the springs being relieved of their load each time. The load should then be increased, and, after another run of 300 feet, the counter should again be noted. A third or fourth run, or more, with increased loads should then be made, the greatest loads being kept well within the limits of elasticity of the springs.

The results obtained should be treated in the following manner:—The several loads should be set off to scale on the base-line of a diagram, like Fig. 1, as $o\,g$, $o\,h$, $o\,l$, and ordinates raised on which should be set off the corresponding mean

Figs. 1–3.—*Diagrams constructed for obtaining Coefficients of the new Plough Dynanometer.*

Fig. 1.

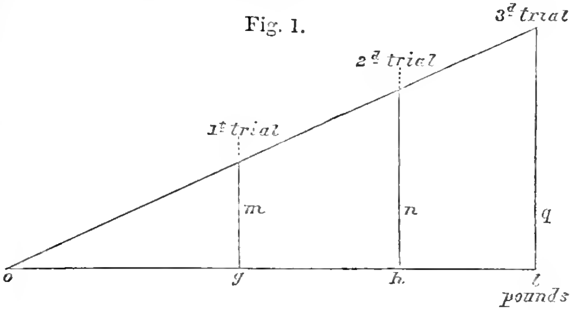


Fig. 2.

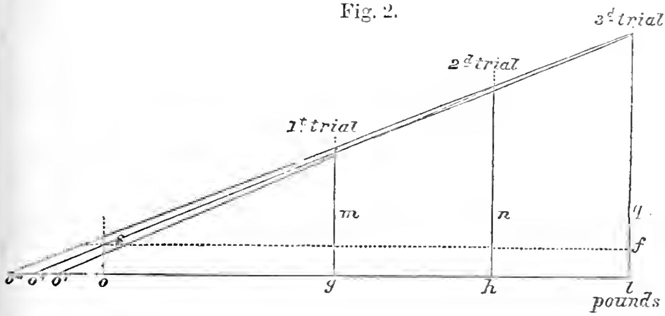
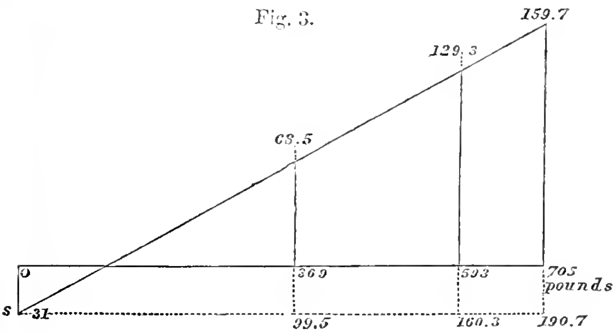


Fig. 3.



indications of the counter, as m, n, and q; then, if the machine is perfect, the line joining the ends of the ordinates would be a straight line, and if produced would pass through o, the zero-point of the base-line. Assume that it does so, then taking any one of the trials, say the third, the work done in foot-pounds will be

$$l \text{ lbs.} \times 300 \text{ ft.} = C \times q,$$

that is, the indications of the counter q, multiplied by the co-efficient C which we are in search of, whence

$$C = \frac{l \text{ lbs.} \times 300 \text{ ft.}}{q};$$

and any of the other trials will give the same value to C.

Having determined C, if we know the distance d, travelled over by the instrument, and in any experiment the reading of the counter, say R, we get the mean draft at once by the equation

$$l = \frac{C \times R}{d}$$

But it frequently happens, especially in inexperienced hands, or if the joints of the instrument are loose, or from the elasticity of the frame, or if there is an initial strain on the springs, or from some or all these causes, that the line joining the ordinates does not, when produced, cut the base at o, but within or beyond it, and the tops of the ordinates themselves are not exactly in a line: in that case draw a line, as in Fig. 2, through the tops of the first and the third ordinates, it will cut the base at o''; take next the second and third, it will cut the base at o''', and so on, combine all the ordinates, and draw the best mean straight line through them, and finally raise a new ordinate at o, and measure its mean height, which will represent the error of the instrument; because if a line $s f$ be drawn through its extremity parallel to the base, the ordinates measured from sf will be nearly in proportion to their distance from o; that is, the indications of the counter with $o s$, deducted in each case, will be proportional to the loads on the springs.

If the mean of the diagonal lines through the ordinates cuts the base-line inside the triangle, as in Fig. 3, then the ordinate $o s$ must be measured downwards, and added to the reading of the counter. A little consideration will show that the co-efficients of error, as we may call $o s$, must vary with the distance traversed by the instrument only, and not with the strain on the springs. If the error arises from looseness of joints, it is plain that the integrating wheel may move a little before the springs come into play, and revolve slowly as the instrument moves, recording work, though none is done; and, therefore, the counter will indicate too much, so that the correction must be deducted: but the joints, having once taken their bearing, will yield no more, however much the spring is strained, and therefore the amount of error will not depend on the strain on the springs. Again, if there is initial strain on the springs, the integrating wheel will remain immovable, recording no work, though work is done, until the draught applied exceed that strain, when it will commence registering; but it will count too

little, and hence the correction must be added: and here again the deficiency will be augmented by the distance passed through, and not by the total strain put upon the springs. It follows that the co-efficient of error, b, must be multiplied by the distance passed over to get its total amount, and the general equation for the work done will be

$$\text{Work done} = C\,(n \pm b \times d) = k \times d$$

where C = co-efficient of work
b = ,, error
n = indications of integrating counter
d = distance run
k = weight or strain on springs.

The mean value of b per unit of distance is ascertained from the diagram thus:—Let x be the correction $o\,s$ for a distance of y feet, then

$$b \times y = x \qquad \therefore\ b = \frac{x}{y};$$

that is to say, the co-efficient b per unit of distance is found by dividing the mean value, x, of the ordinate $o\,s$, by the distance run in making the trials. Therefore

$$k \times d = C\left(n \pm \frac{x \times d}{y}\right) = \text{work done in foot-pounds,}$$

and from that

$$C = \frac{k \times d}{n \pm \dfrac{x \times d}{y}}$$

If an instrument is in good order this equation will give almost identical values of C for all the trials.

If there is no error,

$$x = 0, \qquad \text{and } C = \frac{k \times d}{n},$$

the equation first given.

In using spring-dynamometers, whether rotatory or traction, it is necessary to test the co-efficients frequently, because the springs are liable to take a set. The joints get worn, and the integrating wheel wears smaller. The disc should also be kept off the integrating wheel when not actually used to register, because, as the wheel plays backwards and forwards across its face, as long as the instrument is being drawn along, it is apt to wear into flats, and so get out of shape.

In Fig. 3, a case, which actually occurred in practice with the plough-dynamometer, is worked out. The following were the mean results of the trials:—

Load on Springs.		Mean Reading of Index.		Distance.
705 lbs.	....	159·7	....	192 yards
593 ,,	....	129·3	....	192 ,,
360 ,,	....	68·5	....	192 ,,

On plotting these data it is at once apparent that the line joining the ordinates is very nearly a straight line, but it cuts the base within the zero-point, and hence a correction, $os=31$, must be added to each reading for a distance of 192 yards, or 0·1615 per yard.

Work done, therefore, is, say for the first trial,

$$705 \text{ lbs.} \times 192 \text{ yds.} \times 3 \text{ ft.} = C\,(159 \cdot 7 + 31) = \text{foot-pounds.}$$

$$\text{Then from 1st trial } C = \frac{705 \times 192 \times 3}{190 \cdot 7} = 2129 \cdot 46$$

$$\text{,, 2nd ,, } C = \frac{593 \times 192 \times 3}{160 \cdot 3} = 2130 \cdot 78$$

$$\text{,, 3rd ,, } C = \frac{369 \times 192 \times 3}{99 \cdot 5} = \underline{2136 \cdot 21}$$

$$2132 \cdot 15 \text{ mean.}$$

Results which, it will be seen, agree very well together.

The general equation for these springs is:—Work in foot-pounds$=2132$ (reading of index$+0·1615\times$yards).

We may remark that plain spring-links, and the diagrams traced by the dynamometers, are capable of giving very limited, and frequently very deceptive, information. They are only useful in indicating the maximum and minimum pulls, or exceptional efforts at particular places. It is almost impossible to calculate the mean draught from a diagram, owing to the excessive waviness of the line; and it is not easy to note the extreme positions of the index of a spring-link, on accouut of the quickness of the motion. On the other hand, the integrating counter can be specially noted between any two points of a run, and the mean pull deduced from it. It is found that the measuring-wheel records the distance passed over very accurately, and it is always better, in working out the results, to assume that the distance recorded by the measuring wheel is correct, though it may differ from the actual distance; because if there is any slip, there is also a corresponding reduction in the integrating counter.

We need hardly observe, that the values of C and b may be obtained from any two trials, by solving them as simple equations with two unknown quantities.

Royal Agricultural Society of England.

1875.

President.

VISCOUNT BRIDPORT.

Trustees.

Year when Elected.	
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1857	BRIDPORT, Viscount, *Cricket St. Thomas, Chard, Somersetshire.*
1850	CHESHAM, Lord, *Latimer, Chesham, Bucks.*
1861	DENT, J. D., *Ribston Hall, Wetherby, Yorkshire.*
1863	KINGSCOTE, Colonel, M.P., *Kingscote, Wootton-under-Edge, Gloucestershire.*
1854	MACDONALD, Sir ARCHIBALD KEPPEL, Bt., *Woolmer Lodge, Liphook, Hants.*
1860	MARLBOROUGH, Duke of, K.G., *Blenheim Park, Oxford.*
1846	MILWARD, RICHARD, *Thurgarton Priory, Southwell, Notts.*
1839	PORTMAN, Viscount, *Bryanston, Blandford, Dorset.*
1856	POWIS, Earl of, *Powis Castle, Welshpool, Montgomeryshire.*
1858	RUTLAND, Duke of, K.G., *Belvoir Castle, Grantham, Leicestershire.*
1839	TREDEGAR, Lord, *Tredegar Park, Newport, Monmouthshire.*

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1839	CHICHESTER, Earl of, *Stanmer Park, Lewes, Sussex.*
1867	DEVONSHIRE, Duke of, K.G., *Holker Hall, Lancashire.*
1847	EVERSLEY, Viscount, *Heckfield Place, Winchfield, Hants.*
1848	GIBBS, B. T. BRANDRETH, *Halfmoon Street, Piccadilly, London,* W.
1858	KERRISON, Sir EDWARD C., Bart., *Brome Hall, Scole, Suffolk.*
1839	MILES, Sir WILLIAM, Bart., *Leigh Court, Bristol, Somersetshire.*
1852	RICHMOND, Duke of, K.G., *Goodwood, Chichester, Sussex.*
1859	VERNON, Lord, *Sudbury Hall, Derby.*
1861	WELLS, WILLIAM, *Holmewood, Peterborough, Northamptonshire.*
1855	WYNN, Sir WATKIN WILLIAMS, Bart., M.P., *Wynnstay, Ruabon, Denbighshire.*

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1858	AMOS, CHARLES EDWARDS, 5, *Cedars Road, Clapham Common, Surrey.*
848	*BARNETT, CHARLES, *Stratton Park, Biggleswade, Bedfordshire.*
868	BOOTH, THOMAS CHRISTOPHER, *Warlaby, Northallerton, Yorkshire.*
863	BOWLY, EDWARD, *Siddington House, Cirencester, Gloucestershire.*
861	*CANTRELL, CHARLES S., *Riding Court, Datchet, Bucks.*
866	DAVIES, DAVID REYNOLDS, *Agden Hall, Lymm, Cheshire.*
860	DRUCE, JOSEPH, *Eynsham, Oxford.*
868	EDMONDS, WILLIAM JOHN, *Southrope, Lechlade, Gloucestershire.*
871	EGERTON, Hon. WILBRAHAM, M.P., *Rostherne Manor, Knutsford, Cheshire.*
867	*ESLINGTON, Lord, M.P., *Ravensworth Castle, Durham.*

* Those Members of Council whose names are prefixed by an asterisk retire by
ation in July, but are eligible for re-election in May.

Year when Elected.	
1873	*Evans, John, *Uffington, Shrewsbury, Salop.*
1875	Frankish, William, *Limber Magna, Ulceby, Lincolnshire.*
1874	Hemsley, John, *Shelton, Newark, Notts.*
1873	Horley, Thomas, Jun., *The Fosse, Leamington, Warwickshire.*
1866	Hornsby, Richard, *Spittle Gate, Grantham, Lincolnshire.*
1854	Hoskyns, Chandos Wren, *Harewood, Ross, Herefordshire.*
1871	*Jones, J. Bowen, *Ensdon House, Shrewsbury, Salop.*
1848	Lawes, John Bennet, *Rothamsted, St. Albans, Herts.*
1869	*Leeds, Robert, *Wicken Farm, Castleacre, Brandon, Norfolk*
1872	Leicester, Earl of, K.G., *Holkham Hall, Wells, Norfolk.*
1868	Lichfield, Earl of, *Shugborough, Staffordshire.*
1874	Lindsay, Colonel Loyd, M.P., *Lockinge Park, Wantage, Berkshire.*
1865	*Lopes, Sir Massey, Bart., M.P., *Maristow, Roborough, Devon.*
1871	*McIntosh, David, *Havering Park, Romford, Essex.*
1874	*Martin, Joseph, *Highfield House, Littleport, Isle of Ely, Cambridgeshire*
1871	Masfen, R. Hanbury, *Pendeford, Wolverhampton, Staffordshire.*
1875	Musgrave, Sir R. C., Bart., *Edenhall, Penrith, Cumberland.*
1857	*Pain, Thomas, *The Grove, Basingstoke, Hants.*
1874	*Pole-Gell, H. Chandos, *Hopton Hall, Wirksworth, Derbyshire.*
1861	Randell, Charles, *Chadbury, Evesham, Worcestershire.*
1868	*Ransome, Robert Charles, *Ipswich, Suffolk.*
1871	Rawlence, James, *Bulbridge, Wilton, Salisbury, Wilts.*
1869	*Ridley, M. White, M.P., *Blagdon, Cramlington, Northumberland.*
1861	*Rigden, William, *Hove, Brighton, Sussex.*
1874	Sanday, George Henry, *Wensley House, Bedale, Yorkshire.*
1856	Shuttleworth, Joseph, *Hartsholme Hall, Lincoln.*
1872	*Skelmersdale, Lord, *Lathom Hall, Ormskirk, Lancashire.*
1874	*Spencer, Earl, K.G., *Althorp, Northampton.*
1873	*Torr, John, M.P., *Carlett Park, Eastham, Chester.*
1874	Turbervill, Major Picton, *Ewenny Abbey, Bridgend, South Wales.*
1845	*Turner, George, *Brampford Speke, Exeter, Devonshire.*
1871	*Turner, Jabez, *Haddon, Huntingdonshire.*
1871	*Wakefield, William H., *Kendal, Westmoreland.*
1870	Welby, William Earle, M.P., *Newton House, Folkingham, Lincolnshire*
1870	Whitehead, Charles, *Barming House, Maidstone, Kent.*
1866	*Wilson, Lieut.-Colonel Fuller Maitland, *Stowlangtoft Hall, Bury St. Edmund's, Suffolk.*
1865	*Wilson, Jacob. *Woodhorn Manor, Morpeth, Northumberland.*
1875	*Worsley, W. Cayley, *Hovingham, York.*

Secretary and Editor.

H. M. JENKINS, 12, *Hanover Square, London,* W.

Consulting Chemist—Dr. Augustus Voelcker, F.R.S., 11, *Salisbury Square,* E.C

Consulting Botanist—W. Carruthers, F.R.S., F.L.S., *British Museum,* W.C.

Consulting Veterinary Surgeon — James Beart Simonds, *Royal Veterinary College,* N.W.

Consulting Engineers—Eastons & Anderson, *The Grove, Southwark Street,* S.E.

Seedsmen—Thomas Gibbs and Co., *Corner of Halfmoon Street, Piccadilly,* W.

Publisher—John Murray, 50, *Albemarle Street,* W.

Bankers—The London and Westminster Bank, *St. James's Square Branch,* S.W

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* Those Members of Council whose names are prefixed by an asterisk retire b rotation in July, but are eligible for re-election in May.

STANDING COMMITTEES FOR 1875.

Finance Committee.

KINGSCOTE, Colonel (Chairman).
BRIDPORT, Viscount.
BOOTH, T. C.
DAVIES, D. R.
RANDELL, CHARLES.

House Committee.

THE PRESIDENT.
CHAIRMAN of Finance Committee.
CANTRELL, C. S.
GIBBS, B. T. BRANDRETH.

Journal Committee.

DENT, J. D. (Chairman).
CATHCART, Earl.
VERNON, Lord.
HEMSLEY, J.
HOSKYNS, C. WREN.
JONES, J. BOWEN.
KINGSCOTE, Colonel.
MILWARD, RICHARD.
RIDLEY, M. WHITE.
WELBY, W. E.
WELLS, W.
WHITEHEAD, CHARLES.
WILSON, JACOB.

Chemical Committee.

WELLS, WILLIAM (Chairman).
BEDFORD, Duke of.
LICHFIELD, Earl of.
VERNON, Lord.
DENT, J. D.
EVANS, JOHN.
HOSKYNS, C. WREN.
JONES, J. BOWEN.
LAWES, J. B.
MARTIN, J.
VOELCKER, Dr. A.
WAKEFIELD, W. H.
WELBY, W. E.
WHITEHEAD, CHARLES.
WILSON, JACOB.

Botanical Committee.

WHITEHEAD, CHARLES (Chairman).
VERNON, Lord.
DENT, J. D.
EDMONDS, W. J.
GIBBS, B. T. BRANDRETH.
HOSKYNS, C. WREN.
JONES, J. BOWEN.
TURR, JOHN.
TURNER, JABEZ.
VOELCKER, Dr.
WELBY, W. E.
WELLS, W.

Veterinary Committee.

EGERTON, Hon. WILBRAHAM (Chairman).
BRIDPORT, Viscount.
CATHCART, Earl.
BOOTH, T. C.
BROWN, Professor.
GIBBS, B. T. BRANDRETH.
KINGSCOTE, Colonel.
LINDSAY, Colonel LOYD
MILWARD, R.
POLE-GELL, H. CHANDOS.
RIDLEY, M. WHITE.
SIMONDS, Professor.
WELLS, WILLIAM.
WILSON, JACOB.

Stock-Prizes Committee.

BRIDPORT, Viscount.
BOOTH, T. C.
BOWLY, EDWARD.
DENT, J. D.
DRUCE, JOSEPH.
EVANS, JOHN.
GIBBS, B. T. BRANDRETH.
HEMSLEY, J.
HORLEY, THOMAS.
LEEDS, ROBERT.
LINDSAY, Colonel LOYD.
MACINTOSH, D.
MARTIN, J.
MASFEN, R. H.
MILWARD, RICHARD.
POLE-GELL, H. CHANDOS.
RANDELL, CHARLES.
RIDLEY, M. WHITE.
RIGDEN, WILLIAM.
SANDAY, G. H.
TURNER, GEORGE.
WAKEFIELD, W. H.
WILSON, Colonel.
WILSON, JACOB.
The Stewards of Live Stock.

Implement Committee.

BOOTH, T. C. (Chairman).
BRIDPORT, Viscount.
VERNON, Lord.
AMOS, C. E.
CANTRELL. CHAS. S.
EDMONDS, W. J.
EVANS, JOHN.
GIBBS, B. T. BRANDRETH.
HEMSLEY, J.
HORLEY, T.
HORNSBY, RICHARD.
HOSKYNS, C. WREN.
JONES, J. BOWEN.
LEEDS, ROBERT.
MARTIN, J.
MASFEN, R. H.
MILWARD, R.
RANDELL, CHARLES.
RANSOME, R. C.
SANDAY, G. H.
SHUTTLEWORTH, JOSEPH.
TURNER, JABEZ.
WELBY, W. EARLE.
WHITEHEAD, CHARLES.
WILSON, JACOB.
The Stewards of Implements.

General Taunton Committee.

WYNN, SIR WATKIN W., Bart. (Chairman).
BEDFORD, Duke of.
CATHCART, Earl.
POWIS, Earl of.
BRIDPORT, Viscount.
CHESHAM, Lord.
VERNON, Lord
BARNETT, CHARLES.
BOOTH, T. C.
BOWLY, EDWARD.
BULT, J. S.
CANTRELL, CHARLES S.
DAVIES, D. R.
DRUCE, JOSEPH.
EASTON, R.
EASTON, W.
EDMONDS, W. J.
GIBBS, B. T. BRANDRETH.
HEMSLEY, J.
HORNSBY, RICHARD.
KNOLLYS, J. E.
LEEDS, ROBERT.
LUTTRELL, Colonel.
MASFEN, R. H.
MILWARD, RICHARD.
PENNY, T.
POLE-GELL, H. C.
RANDELL, CHARLES.
RANSOME, R. C.
RIDLEY, M. W.
SHUTTLEWORTH, JOSEPH.
TAYLOR, P.
TURNER, G.
TURNER, JABEZ.
WAKEFIELD, W. H.
WELLS, WILLIAM.
WHITEHEAD, CHARLES.
WILSON, JACOB.

Show-Yard Contracts Committee.

BRIDPORT, Viscount.
VERNON, Lord.
AMOS, C. E.
BOOTH, T. C.
GIBBS, B. T. BRANDRETH.
HORLEY, T.
HORNSBY, RICHARD.
MILWARD, RICHARD.
RANDELL, CHARLES.
SHUTTLEWORTH, JOSEPH.
WILSON, JACOB.

Committee of Selection.

KINGSCOTE, Colonel (Chairman).
CATHCART, Earl.
BRIDPORT, Viscount.
DENT, J. D.
EGERTON, Hon. W.
MILWARD, R.
RANDELL, CHARLES.
WAKEFIELD, W. H.
WELLS, WILLIAM.
WHITEHEAD, C.

And the Chairmen of the Standing Committees.

Education Committee.

BEDFORD, Duke of (Chairman).
ACLAND, Sir T. DYKE, Bart.
LOPES, Sir MASSEY, Bart.
DENT, J. D.
JONES, J. BOWEN.
KINGSCOTE, Colonel.
MACINTOSH, DAVID.
VOELCKER, Dr.
WELLS, WILLIAM.
WHITEHEAD, CHARLES.

Cattle Plague Committee.

THE WHOLE COUNCIL.

*** The PRESIDENT, TRUSTEES, and VICE-PRESIDENTS are Members *ex officio* of all Committees.

Royal Agricultural Society of England.

GENERAL MEETING,

12, Hanover Square, Thursday, December 10th, 1874.

REPORT OF THE COUNCIL.

The Council of the Royal Agricultural Society have to report that, during the year 1874, the number of Governors and Members has been increased by the election of 3 Governors and 349 Members, and diminished by the death of 5 Governors and 143 Members, the resignation of 174 Members, and the removal of 39 Members by order of the Council.

The Society now consists of:—

78 Life Governors,
56 Annual Governors,
1994 Life Members,
3843 Annual Members,
11 Honorary Members,

making a total of 5982.

The changes which have taken place in the Council since the election last May have been unusually large. They have been caused by the deaths of Sir Harry Stephen Meysey-Thompson, Bart., a Trustee of the Society; the Earl of Egmont, a Vice-President of the Society; Mr. J. Wells, of Booth Ferry, Howden; Mr. James Webb, of Fladbury, Pershore; and Mr. N. G. Barthropp, of Hacheston, Wickham Market; Members of Council of the Society; and by the resignation of Viscount Hill, a Vice-President of the Society.

The death of Sir Harry Stephen Meysey-Thompson calls for more than a simple record on the part of the Council, of which he was an an original Member. As Mr. H. S. Thompson, of Kirby Hall, York, he succeeded Mr. Pusey as Editor of the Society's 'Journal,' and as Chairman of the 'Journal' Committee. He was for many years a Trustee of the Society; and filled the

office of President in the year 1866–67. His writings in the Society's 'Journal' admirably set forth the lessons which may be drawn from the facts revealed by chemistry and statistics, combined with those obtained by agricultural practice; and his interest in the welfare of the Society was apparent on every important occasion. The Council, in expressing their deep regret at the loss of the highly valued services of their lamented colleague, refer the Members of the Society to the memoir of him, published in the last number of the 'Journal,' for which their ex-President, Earl Cathcart, has earned their warmest thanks.

The vacancies thus created in the Council have been filled up as follows:—Col. Kingscote has been elected a Trustee in the place of Sir H. S. Meysey-Thompson; the Duke of Bedford has been elected a Vice-President, in the room of the Earl of Egmont, and Mr. W. Wells in the place of Viscount Hill; and the following gentlemen have been elected Members of the Council:—the Earl Spencer, K.G., of Althorp, Northamptonshire; Mr. J. Martin, of Littleport, Ely; Mr. H. C. Pole-Gell, of Hopton Hall, Wirksworth; and Major Picton-Turbervill, of Ewenny Abbey, Glamorganshire.

There are still two vacancies on the Council, which will probably be filled up in February.

The half-yearly statement of accounts to the 30th June, 1874, has been examined and approved by the Society's auditors and accountants, and has been published for the information of the Members in the last number of the 'Journal.' The funded capital has since then been reduced by the sum of 3000*l.* New Three per Cents., which have been sold out to meet the deficiency in the receipts at the Bedford Meeting. The funded property of the Society is now 21,112*l.* 7*s.* 8*d.* New Three per Cents., and the balance in the hands of the bankers on the 1st instant was 1564*l.* 5*s.* 11*d.*

More than 370 implements were entered for trial at the Bedford County Meeting in 33 Classes as follows:—135 Drills in 12 Classes; 105 Horse-hoes in 5 Classes; 16 Manure Distributors in 2 Classes; 19 Waggons in 3 Classes; 74 Carts in 8 Classes; 7 Movable Huts in 2 Classes; and 15 Entries for the Special Prize for the best Guard to the Drum of a Threshing-Machine.

A very exhaustive report of the trials, with concise descriptions of the Prize Implements, has been written by Mr. G. Purves Smith, and published in the last number of the 'Journal.' This report is elucidated by numerous tables of the Dynamometrical and other results, including the points awarded to the several implements by the Judges, and a large number of illustrations of the most prominent mechanical novelties.

The immense number of Prize Implements rendered their special exhibition, on the plan that was first tried at Hull last year, particularly acceptable to those who were desirous of purchasing implements in those classes, as the task of comparison would have been exceedingly laborious if they had been seattered though the longest range of Implement Shedding which has ever been erected in one of the Society's Show-yards.

The Show of Horses at Bedford was also the largest which has hitherto been held under the auspices of the Society; and, although larger numbers of cattle and of sheep have occasionally been entered, the Show of Live Stock, as a whole, accorded with the Show of Implements, in being the most extensive in the records of the Society.

The competition for Lord Charles Russell's Cup, value 50*l.*, with a purse of 50 sovereigns, and the Society's second prize of 50*l.*, for the best-managed farm in Bedfordshire, was exceedingly close, and excited great interest in the county. The report on this competition, written by Mr. G. H. Sanday, one of the Judges, has also been published in the last number of the 'Journal.'

The Council reported to the Annual Meeting, last May, that they wished to increase the usefulness of these competitions, especially with a view to obtaining, for publication in the 'Journal,' more complete descriptions of the best examples of farm-management in the locality in which the Country Meetings are held. They, therefore, made known last July the prizes and conditions of the competition in connection with the Taunton Meeting, and fixed October 31st as the last date of entry. They offered a first prize of 50*l.*, and a second prize of 25*l.*, in each of the three following classes:—(1) Hill-farms, (2) Dairy-farms, and (3) Farms not qualified to compete in either of the foregoing classes. Two hill-farms, three dairy-farms, and twelve farms in Class 3, have been entered to compete for these prizes, and the Judges have already made their first tour of inspection.

The Prizes for Live Stock to be offered by the Society at the Taunton Meeting, next year, amount to 3165*l.* The list includes extra classes for ponies, as well as for Exmoor, Dartmoor, and Somerset and Dorset horned sheep.

The Taunton Local Committee have added to the Society's Prize-sheet, offers of Prizes for Devon Long-woolled Sheep, Butter, Cheese, and Long Wool.

The Council have appointed a Special Committee to revise the list of Judges of Stock and Implements.

The implements to be tried at Taunton, next year, are those connected with the hay-harvest, and include mowing and hay-making machines, and horse-rakes, as well as machines for drying hay in wet weather, sufficiently economical for practical purposes. In accordance with the recommendation of the Judges at Bedford appointed to test the inventions entered to compete for the Special Prize for the best Guard, or appliance, to the Drum of a Threshing-Machine, for preventing accidents to the people employed, the Council have added to the Taunton Prize-sheet two separate prizes, one for the best Guard to a Threshing-Machine, and the other for the best combined Guard and Feeder.

Last June the Council represented to the Lord President of the Privy Council that, in order to deal efficiently with the whole question of the contagious and infectious diseases of animals, there was urgent need of such regulations as were recommended by them in December, 1872; but that, as several of those recommendations would require the sanction of Parliament to enable them to be put in force, they made some less extensive recommendations in view of the pressing necessity of dealing immediately with the then renewed outbreak of foot-and-mouth disease. The Privy Council, in the course of that month, issued orders having special reference to that disease, which, in their general scope, coincided with the recommendations of the Council.

The Council regret that up to the present time they have had no means of obtaining any information as to the effect of the Orders of Privy Council in checking the progress of disease, and they have therefore resolved to make application to the Chairman of Quarter Sessions in each county, to furnish from time to time, any information in their power from the reports

of their inspectors with regard to the working of the Orders in Council, and their effect in checking spread of disease, or otherwise.

The Council have the gratification to announce that their repeated representations to the Peruvian Legation, either directly or through the Secretary of State for Foreign Affairs, as to the unsatisfactory basis on which the guano trade has hitherto been conducted, have now met with a favourable reception by the Peruvian Government. Three bills have been laid before the Peruvian Congress, having for their object the sale of guano by standard analysis, as the Council have from time to time recommended. The immediate cause of this action on the part of the Peruvian Government was Dr. Voelcker's report on 13 samples of Peruvian guano, which had been forwarded to the Council, for analysis and report, by the Lords of the Admiralty, through the Foreign Office. Dr. Voelcker's analysis and report were forwarded to the Secretary of State for Foreign Affairs, and by him communicated to the Peruvian Government, by whom they were ordered to be translated and published in the Official 'Journal,' together with a letter signed by Lord Cathcart, on behalf of the Council. The bills that have since been laid before the Peruvian Congress are apparently based on those documents; and the Council sincerely hope that the proposed alteration of the basis of the guano trade will soon become an accomplished fact.

A further communication has been forwarded from the Secretary of State for Foreign Affairs, enclosing a despatch from Mr. Marsh, Acting Consul-General at Lima, which intimates that some restrictions may probably be placed upon the manufacture and trade in Nitrate of Soda, in the shape of increased export duties upon that article. The Council have expressed to Lord Derby a hope that the Foreign Office will remonstrate strongly against any such restrictions, as being likely to interfere very seriously with one of the most valuable sources of artificial manure at present available. In alluding to this matter the Council have to remark that they are much indebted to the Secretary of State for Foreign Affairs for his great courtesy in forwarding to them the information on this subject, and for the active part which the Government have taken in endeavouring to have the guano trade placed upon a satisfactory footing.

The analyses of cakes, manures, and other substances, made by Dr. Voelcker, for Members of the Society, during the year ending November 30th, 1874, were 648, a slight decrease from the preceding year, but still far in excess of those of some previous years; and the Council have good reason to believe, that the action taken by their Chemical Committee in publishing the Quarterly Reports of cases submitted to their notice, has had a salutary effect in reducing the number of inferior articles sold to their Members. The pricipal cause of complaint now arises in respect to cakes made from linseed not thoroughly screened.

With regard to the competition for prizes for potatoes that will resist disease for three years in succession, in twenty different districts of the United Kingdom, the Judges appointed to inspect the growth of the six varieties of potatoes which were entered for competition, and planted in trial plots in twenty different places in England, Scotland and Ireland, have reported that none of the varieties have resisted the potato disease.

A Special Committee has been appointed to take into consideration the Society's Charter, and to suggest what alterations, if any, are advisable to be made therein, for the purpose of bringing Members of Council into more frequent communication with Members of the Society.

Some important suggestions having been made by Members of the Soeiety at the General Meeting held in the Show-yard at Bedford, they were referred to a Special Committee. On the report of that Committee upon those suggestions, the Council have resolved as follows:—

As regards Mr. Thos. Chambers' letter respecting the Trials of Implements: that the Stewards of Implements and the Honorary Director should consider before the Council Meeting in June, whether any Programme of Trials can be arranged, indicating about what day the trials of particular classes will commence, so as to enable Implement Exhibitors and Members of the Society to attend those trials in which they are interested; and, that the same be published in the Programme of the Country Meeting issued to the Members of the Society.

In reference to Mr. Thos. Willson's suggestions, the Council are of opinion that the election of Members to replace those who retire by rotation should be left entirely to the Members of the

Society, who shall vote either in person or by proxy, and that the Special Charter Committee have power to propose in May revised Bye-laws for that purpose.

As respects Mr. Fawcett's suggestions, taken in order, the Council have resolved :—

(i.) That as there is only one large show in England which takes place before that held by the Royal Society, viz., that of the Bath and West of England, it should be arranged that Judges who act there should not act at the Royal Show in Classes of the same kind of stock.

(ii.) They beg to call attention to the fact that instructions are always given to the Judges to bear in mind the objects of the Society, viz., the encouragement of good breeding animals; and they would further remind Mr. Fawcett and the other Members of the Society of the conditions attached to Prize-takers in the Female Classes.

(iii.) The Council think this suggestion impossible to carry out, but are of opinion that the complete Catalogue should be placed in the Judges' hands.

(iv., v., vi.) With reference to the appointment of Judges, the Council consider that, while the Society endeavours, by applying to local Societies as well as to its own Members, to secure continually new and efficient Judges, Mr. Fawcett's suggestions would not assist them in their efforts. But they think it advisable that the Society should continue its practice of securing, as far as practicable, that not more than one of the three Judges should have acted at the Show of the previous year in the same Classes of Animals.

(vii.) As to the ages of animals exhibited at the Society's Shows being calculated up to the 1st of July, the Council think that it is a subject worthy of consideration whether, after due notice, the date should not be altered to the 1st of January in each year.

The Education Grant for the current year has been increased to the sum of 500*l*., for the purpose of carrying out the examinations for Scholarships, to be held by pupils of Middle-Class and other Schools, on the plan reported at the last Annual Meeting. The examinations were held on the 17th and 18th November, two candidates having been entered from the Bedford Middle-Class Public School, and twenty-seven from the Surrey County School at Cranleigh.

Scholarships of the value of 20*l*. each, tenable for one year, have been gained by the following candidates :—

William Henry Richmond, Surrey County School, Cranleigh.

Hubert Nicholls, Surrey County School, Cranleigh.

Walter Gardiner, Beds. Middle-Class Public School.

The Council are satisfied with the success of this first Examination and with the encouraging nature of the reports of the

Examiners, and they trust that an increasing number of Candidates will be sent up from other Schools at the next Examination. The Council wish to call the attention of the Members of the Society to this scheme, and to request them to bring it to the notice of the public schools of their respective localities.

The Education Grant has been renewed to the same amount for the year 1875, to enable both the senior and junior scheme of examinations to be continued on the same basis as this year.

By order of the Council,

H. M. JENKINS,

Secretary.

MEMORANDA.

Address of Letters.—The Society's office being situated in the postal district designated by the letter W, members, in their correspondence with the Secretary, are requested to subjoin that letter to the usual address.

General Meeting in London, May 22, 1875, at 12 o'clock.

Meeting at Taunton, July 12th, 1875, and four following days.

General Meeting in London, December, 1875.

Monthly Council (for transaction of business), at 12 o'clock on the first Wednesday in every month, excepting January, September, and October: open only to Members of Council and Governors of the Society.

Adjournments.—The Council adjourn over Passion and Easter weeks, when those weeks do not include the first Wednesday of the month; from the first Wednesday in August to the first Wednesday in November; and from the first Wednesday in December to the first Wednesday in February.

Office Hours.—10 to 4. On Saturdays, from the Council Meeting in August until the Council Meeting in April, 10 to 2.

Diseases of Cattle, Sheep, and Pigs.—Members have the privilege of applying to the Veterinary Committee of the Society, and of sending animals to the Royal Veterinary College on the same terms as if they were subscribers to the College.—(A statement of these privileges will be found in this Appendix.)

Chemical Analysis.—The privileges of Chemical Analysis enjoyed by Members of the Society will be found stated in this Appendix.

Botanical Privileges.—The Botanical Privileges enjoyed by Members of the Society will be found stated in this Appendix.

Subscriptions.—1. Annual.—The subscription of a Governor is £5, and that of a Member £1, due in advance on the 1st of January of each year, and becoming in arrear if unpaid by the 1st of June. 2. For Life.—Governors may compound for their subscription for future years by paying at once the sum of £50, and Members by paying £10. Governors and Members who have paid their annual subscription for 20 years or upwards, and whose subscriptions are not in arrear, may compound for future annual subscriptions, that of the current year inclusive, by a single payment of £25 for a Governor, and £5 for a Member.

Payments.—Subscriptions may be paid to the Secretary, in the most direct and satisfactory manner, either at the Office of the Society, No. 12, Hanover Square, London, W., or by means of post-office orders, to be obtained at any of the principal post-offices throughout the kingdom, and made payable to him at the Vere Street Office, London, W.; but any cheque on a banker's or any other house of business in London will be equally available, if made payable on demand. In obtaining post-office orders care should be taken to give the postmaster the correct initials and surname of the Secretary of the Society (H. M. Jenkins), otherwise the payment will be refused to him at the post-office on which such order has been obtained; and when remitting the money-orders it should be stated by whom, and on whose account, they are sent. Cheques should be made payable as drafts on demand (not as bills only payable after sight or a certain number of days after date), and should be drawn on a London (not on a local country) banker. When payment is made to the London and Westminster Bank, St. James's Square Branch, as the bankers of the Society, it will be desirable that the Secretary should be advised by letter of such payment, in order that the entry in the banker's book may be at once identified, and the amount posted to the credit of the proper party. No coin can be remitted by post, unless the letter be registered.

New Members.—Every candidate for admission into the Society must be proposed by a Member; the proposer to specify in writing the full name, usual place of residence, and post-town, of the candidate, either at a Council meeting, or by letter addressed to the Secretary. Forms of Proposal may be obtained on application to the Secretary.

*** Members may obtain on application to the Secretary copies of an Abstract of the Charter and Bye-laws, of a Statement of the General Objects, &c., of the Society, of Chemical, Botanical, and Veterinary Privileges, and of other printed papers connected with special departments of the Society's business.

Royal Agricultural Society of England.

1875.

DISTRIBUTION OF MEMBERS OF THE SOCIETY AND OF MEMBERS OF COUNCIL.

Districts.	Counties.	Number of Members.	Number in Council.	Members of Council.
A.	Durham	91	1	Lord Eslington.
	Northumberland	129	2	M. White Ridley; Jacob Wilson.
	Yorkshire — North and East Ridings	183	3	Earl Cathcart, v.p.; T. C. Booth; G. H. Sanday.
		403	6	
B.	Bedfordshire	78	2	Duke of Bedford, v.p.; C. Barnett.
	Cambridgeshire	87	1	J. Martin.
	Essex	113	1	D. McIntosh.
	Hertfordshire	116	1	J. B. Lawes.
	Huntingdonshire	42	2	Jabez Turner; W. Wells, v.p.
	Norfolk	160	2	Earl of Leicester; Robert Leeds.
	Suffolk	153	2	Sir E. C. Kerrison, v.p.; Lieutenant-Colonel Wilson.
		749	11	
C.	Cornwall	41		
	Devonshire	95	3	Sir T. D. Acland, t.; Sir M. Lopes; G. Turner.
	Dorsetshire	60	1	Lord Portman, t.
	Somersetshire	128	2	Viscount Bridport, t.; Sir W. Miles, v.p.
	Wiltshire	105	1	J. Rawlence.
		429	7	
D.	Derbyshire	88	2	Lord Vernon, v.p.; H. Chandos Pole-Gell.
	Leicestershire	103	1	Duke of Rutland, t.
	Lincolnshire	217	2	W. Frankish; W. Earle Welby.
	Northamptonshire	110	1	Earl Spencer.
	Nottinghamshire	136	2	R. Milward, t.; J. Hemsley.
	Rutlandshire	17		
	Warwickshire	157	1	T. Horley, jun.
		828	9	

DISTRIBUTION OF MEMBERS OF THE SOCIETY—*continued.*

Districts.	Counties.	Number of Members.	Number in Council.	Members of Council.
E.	Cumberland	96 ..	1	Sir R. C. Musgrave.
	Lancashire	231 ..	2	Duke of Devonshire, V.P.; Lord Skelmersdale.
	Westmoreland ..	66 ..	1	W. H. Wakefield.
	Yorkshire — West Riding	145 ..	2	J. D. Dent, T.; W. Cayley Worsley.
		—— 538	— 6	
F.	Gloucestershire ..	195 ..	3	E. Bowly; W. J. Edmonds; Col. Kingscote, T.
	Herefordshire ..	94 ..	1	C. Wren Hoskyns.
	Monmouthshire ..	54 ..	1	Lord Tredegar, T.
	Worcestershire ..	135 ..	1	C. Randell.
	South Wales	149	1	Major P. Turbervill.
		—— 627	— 7	
G.	Berkshire	127 ..	1	Colonel Loyd Lindsay.
	Buckinghamshire ..	65 ..	2	Lord Chesham, T.; C. S. Cantrell.
	Hampshire	142 ..	3	Viscount Eversley, V.P.; Sir A. K. Macdonald, T.; T. Pain.
	Kent	278 ..	1	C. Whitehead.
	Middlesex	284 ..	1	B. T. Brandreth Gibbs, V.P.
	Oxfordshire	138 ..	2	Duke of Marlborough, T.; J. Druce.
	Surrey	124 ..	1	C. E. Amos.
	Sussex	134 ..	3	Earl of Chichester, V.P.; Duke of Richmond, V.P.; W. Rigden.
		——1292	— 14	
H.	Cheshire	161 ..	3	D. R. Davies; Hon. W. Egerton; John Torr.
	Shropshire	324 ..	2	John Evans; J. B. Jones.
	Staffordshire ..	281 ..	2	Earl of Lichfield; R. H. Masfen.
	North Wales ..	125 ..	2	Earl of Powis, T.; Sir W. Wynn, V.P.
		—— 891	— 9	
				Implement Makers.
				R. Hornsby.
				R. C. Ransome.
				J. Shuttleworth.
Scotland		70		
Ireland		83		
Channel Islands		11		
Isle of Man		2		
Foreign Countries		82		
Members without addresses ..		73		
		—— 321		

ROYAL AGRICULTURAL

DR. HALF-YEARLY CASH ACCOUNT

	£	s.	d.	£	s.	d.	£	s.	d.
To Balance in hand, 1st July, 1874:—									
Bankers				2,552	2	9			
Secretary				41	19	11			
				2,594	2	8			
At Deposit				2,000	0	0			
							4,594	2	8
To Income:—									
Subscriptions:—									
Governor's Life-Composition	40	0	0						
Governor's Annual	5	0	0						
Members' Life-Compositions	460	0	0						
Members' Annual	715	0	0						
				1,220	0	0			
Dividends on Stock				358	13	5			
Interest on Deposit				18	5	5			
Journal:—									
Sales	130	17	7						
Advertisements	54	7	9						
				185	5	4			
Sundries:—									
Sale of Waste Paper, &c.				6	1	6			
Farm Inspection:—									
Lord C. Russell's Prize	50	0	0						
Entry Fees for 1875	34	0	0						
				84	0	0			
Hull Meeting				48	18	0			
Total Income							1,921	3	8
To Capital:—									
Sale of Country Meeting Plant				11	7	3			
To Bedford Meeting				7,250	17	0			
To Stock:—									
Sale of 3000*l*. New 3 per Cents.				2,741	5	0			
							10,003	9	3
							£16,518	15	7

BALANCE-SHEET,

LIABILITIES.	£	s.	d.	£	s.	d.	£	s.	d.
To Capital:—									
Surplus, 30th June, 1874				29,334	1	9			
Less Surplus of Expenditure over Income during the Half-year, viz.:—									
Expenditure	3,071	18	11						
Income	1,921	3	8						
	1,150	15	3						
Less half-year's interest and depreciation on Country Meeting Plant	197	13	10						
				1,348	9	1			
							27,985	12	8
To Bedford Meeting Excess of Expenditure over Receipts							3,258	5	8
							£24,727	7	0

QUILTER, BALL, & CO., *Accountants.*

SOCIETY OF ENGLAND.

ROM 1ST JULY TO 31ST DECEMBER, 1874. CR.

	£ s. d.	£ s. d.	£ s. d.
By Expenditure:—			
Establishment:—			
Salaries, Wages, &c.	537 10 0		
House:—Rent, Taxes, Repairs, &c.	357 9 11		
Office:—Printing, Postage, Stationery, &c. ..	178 4 0		
		1,073 3 11	
Journal:—			
Printing and Stitching	574 19 0		
Postage and Delivery	159 0 0		
Literary Contributions	117 0 0		
Woodcuts	87 9 0		
Lithographing	70 0 0		
Advertising..	7 0 6		
		1,015 8 6	
Editor's Journey to Sweden, Norway, and Denmark		150 0 0	
Chemical:—			
Consulting Chemist's Salary		150 0 0	
Botanical:—			
Consulting Botanist's Salary		50 0 0	
Education:—			
Printing, Advertising, &c.		17 19 6	
Farm Inspection:—			
Prizes	100 0 0		
Judges	206 8 10		
Printing and Advertising for 1875	29 19 6		
		336 8 4	
Sundries:—			
Surveyor's Journey to Harrogate		10 10 0	
Potato Disease Investigation		261 4 2	
Stock:—			
Expenses of Transfer		7 4 6	
			3,671 18 11
Total Expenditure			
By Capital Account:—			
Country Meeting Plant		252 12 0	
By Country Meetings:—			
Bedford	12,536 0 2		
Taunton	122 3 9		
		12,658 3 11	
			12,910 15 11
By Balance in hand, 30th December:—			
Bankers		514 0 9	
Secretary..		22 0 0	
			536 0 9
			£16,518 15 7

1ST, DECEMBER 1874.

ASSETS.	£ s. d.	£ s. d.
By Cash in hand	536 0 9	
By New 3 per Cent. Stock 21,112*l.* 7*s.* 8*d.* cost*	20,179 2 1	
By Books and Furniture in Society's House	1,451 17 6	
By Country Meeting Plant	2,438 2 11	
		24,605 3 3
By Taunton Meeting (Balance)	.. .. ..	122 3 9
		£24,727 7 0

* *Value at* 91¾ = £19,370 14*s.* 4*d.*

Mem.—The above Assets are exclusive of the amount recoverable in respect of arrears of Subscription to 31st December, 1874, which at that date amounted to 1008*l.*

Examined, audited, and found correct, this 15th day of February, 1875.

FRANCIS SHERBORN,
A. H. JOHNSON,
HENRY CANTRELL.
} *Auditors on behalf of the Society.*

ROYAL AGRICULTURAL

DR. YEARLY CASH ACCOUNT

	£. s. d.	£. s. d.	£. s. d.
To Balance in hand, 1st Jan. 1874:—			
Bankers	. .	433 18 9	
Secretary	. .	54 19 10	
			488 18 7
To Income:—			
Dividends on Stock	. .	715 16 8	
Interest on Deposit Account	. .	18 5 5	
Subscriptions:—			
Governors' Life-Compositions	80 0 0		
Governors' Annual	290 0 0		
Members' Life-Compositions	1,045 0 0		
Members' Annual	3,854 15 0		
		5,269 15 0	
Journal:—			
Sales	198 2 11		
Advertisements	233 8 10		
		431 11 9	
Farm-Inspection:—			
Entry Fees for 1874	29 0 0		
Lord C. Russell's Prize	50 0 0		
Entry Fees for 1875	34 0 0		
		113 0 0	
Sundries:—			
Sale of Waste Paper	. .	6 1 6	
Total Income	. .	. .	6,554 10 4
To Capital:—			
Sale of Country Meeting Plant	. .	. .	11 7 3
To Stock:			
Sale of £3000 New 3 Per Cents.	. .	. .	2,741 5 0
To Country Meetings:—			
Hull	. .	136 13 0	
Bedford	. .	12,752 12 7	
			12,889 5 7
			£22,685 6 9

SOCIETY OF ENGLAND.

ROM 1ST JANUARY TO 31ST DECEMBER, 1874. CR.

	£. s. d.	£. s. d.	£. s. d.
y Expenditure:—			
Establishment:—			
Salaries, Wages, &c.	1,075 0 0		
House: Rent, Taxes, Repairs, &c.	630 9 4		
Office: Printing, Postage, Stationery	410 19 1		
		2,116 8 5	
Journal:—			
Printing and Stitching	986 17 9		
Postage and Carriage	291 0 0		
Literary Contributions	262 1 0		
Woodcuts	151 15 0		
Lithographing	70 0 0		
Advertising	16 14 6		
		1,778 8 3	
Editor's Journey to Scandinavia	. .	150 0 0	
Chemical:—			
Consulting Chemist's Salary	300 0 0		
Grant for Investigations	200 0 0		
		500 0 0	
Veterinary:—			
Royal Veterinary College (1873)	. .	200 0 0	
Botanical:—			
Consulting Botanist's Salary	. .	100 0 0	
Education:—			
Fees to Examiners	36 15 0		
Prize	25 0 0		
Printing, Advertising, &c.	47 7 8		
		109 2 8	
Farm Inspection:—			
Advertising	31 13 9		
Prizes	100 0 0		
Judges	206 8 10		
Printing and Advertising for 1875	29 19 6		
		368 2 1	
Potato Disease Investigations	. .	417 12 8	
Subscriptions (paid in error) returned	. .	2 0 0	
Sundries:—			
Books for Library	26 17 5		
Expenses of Inspection Committee	14 13 0		
Surveyor's Journey to Harrogate Show	10 10 0		
		52 0 5	
Stock:			
Expenses of Transfer	. .	7 4 6	
Total Expenditure	. .	. .	5,800 19 0
By Capital Account:—			
Country Meeting Plant	. .	252 12 0	
By Country Meetings:—			
Hull	98 17 10		
Bedford	15,874 13 5		
Taunton	122 3 9		
		16,095 15 0	
			16,348 7 0
By Balance in hand, 31st Dec.:—			
Bankers	. .	514 0 9	
Secretary	. .	22 0 0	
			536 0 9
			£22,685 6 9

COUNTRY MEETING

Receipts.

	£.	s.	d.
Subscription from Bedford	2,000	0	0
Admissions to Show Yard by Payment	5,407	16	0
Admissions by Season Tickets	173	1	0
Admissions to Grand Stand by Payment	138	18	6
Sale of Catalogues	484	4	0
Entries in Implement Catalogue	440	0	0
Implement Exhibitors' Payments for Shedding	2,239	11	1
Non-Members' Fees for entry of Implements	213	0	0
Fees for entry of Live Stock	544	0	0
Fees for Horse Boxes and Stalls	323	10	0
Premiums for Supply of Refreshments	385	0	0
Premium for Manure	15	0	0
Premium for Cloak Rooms and Lavatories	60	0	0
Fines for Non-Exhibition of Live-Stock	60	0	0
Reference Number Fines	14	17	6
	12,498	18	1
Balance of Expenditure over Receipts	3,717	0	0
	£16,215	18	1

ACCOUNT, BEDFORD, 1874.

EXPENDITURE.

	£.	s.	d.	£.	s.	d.
Show Yard Works:—viz. Carriage, Storage, Erecting and Painting, taking to pieces, Packing and Insurance of Permanent Buildings, and other Plant	646	3	9			
Implement Sheds, 1529*l.* 17*s.* 9*d.*; Seed and Model Sheds, 181*l.* 18*s.* 6*d.*	1711	16	3			
Stock Sheds, 752*l.* 14*s.* 2*d.*; Horse Boxes, 1102*l.* 9*s.* 10*d.*; Fodder Sheds, 142*l.* 15*s.* 9*d.*	1997	19	9			
Hurdles, 245*l.* 4*s.* 6*d.*; Fences, Gates, &c., 348*l.* 7*s.* 10*d.*	593	12	4			
Tents and Fittings, 69*l.* 16*s.* 9*d.*; Awnings, 52*l.* 3*s.* 10*d.*	122	0	7			
Lavatories and Closets, 186*l.* 4*s.* 6*d.*; other Offices, Buildings, &c., 19*l.* 5*s.* 1*d.*	205	9	7			
Platform inside Entrances, 54*l.* 8*s.* 6*d.*; Signs and Notice Boards, 118*l.* 10*s.* 7*d.*	172	19	1			
Other Works, 179*l.* 3*s.* 5*d.*; Grand Stand, 118*l.* 15*s.*	297	18	5			
Royal Tent and Fittings	99	10	8			
Trial Fields, 43*l.* 8*s.* 4*d.*; Surveyor, 201*l.* 6*s.* 9*d.*	244	15	1			
Depreciation of Plant	403	4	1			
				6,495	9	7
Half cost of Trial Fields				225	0	0
Judges: Implements, 254*l.* 1*s.* 1*d.*; Stock, 290*l.* 14*s.* 7*d.*				544	15	8
Consulting Engineers and Assistants				258	6	2
Inspectors: Veterinary, 51*l.* 19*s.* 9*d.*; Shearing, 34*l.* 18*s.* 6*d.*				86	18	3
Police: Metropolitan, 285*l.* 16*s.* 8*d.*; County, 41*l.*				326	16	8
Clerks and Assistants: Secretary and official Staff, 75*l.* 19*s.* 2*d.*; Hon. Director, 49*l.* 17*s.* 1*d.*; Bankers, 23*l.* 2*s.*				148	18	3
Assistant Steward of Implements				34	13	0
Foremen: Implements, 17*l.* 2*s.*; Trials, 30*l.* 12*s.* 2*d.*; Stock, 15*l.*; Horse Ring, 10*l.* 2*s.*; Cattle Ring, 9*l.* 13*s.*; Horses at Trials, 16*l.*; Fodder Yard, 15*l.*				113	9	2
Fieldmen, Yardmen, Labourers, and Grooms				250	6	3
Index-Clerk and Money Takers, 64*l.* 13*s.* 3*d.*; Doorkeepers and Money-changer, 49*l.* 5*s.* 2*d.*				113	18	5
Stewards' Lodgings and Expenses				111	1	5
Lodgings for Judges and other Officials				179	7	6
Refreshments, 223*l.* 2*s.* 9*d.*; ditto to Royal Tent, 16*l.* 3*s.* 3*d.*				239	6	0
Catalogues: Implements, 270*l.* 1*s.* 9*d*; Awards, 8*l.* 3*s.*; Stock, 119*l.* 7*s.* 9*d.*; Awards, 65*l.* 13*s.*; Plan of Yard, 30*l.*; Sellers, 33*l.* 10*s.*; Carriage and Packing, 13*l.* 18*s.* 10*d.*				540	14	4
Printing				653	15	1
Advertising and Bill Posting				764	10	6
Hay, 150*l.* 15*s.* 11*d.*; Straw, 235*l.* 18*s.* 7*d.*; Green Food, 336*l.* 13*s.* 1*d.*; Mangolds, 14*l.*; Surveying Crops, 2*l.* 4*s.* 6*d.*				739	12	1
Postage, Telegrams, Carriage, Stationery, Badges, &c.				112	14	6
Repairs, Insurance, and Carriage of Testing Machinery				32	18	3
Horse Hire, 204*l.* 12*s.* 6*d.*; Carriages and Cabs, 56*l.* 4*s.* 11*d.*				260	17	5
Coals, 2*l.* 16*s.*; Lanterns, 1*l.* 13*s.*; Drugs, &c., 2*l.* 8*s.* 8*d.*				6	17	8
Seeds, Bones, Burnt Earth, Ashes, Soot, &c., used at Trials				55	7	7
Hire of Weighing Machines, 1*l.* 12*s.* 6*d.*; Hire of Shovels, &c., 2*l.*				3	12	6
Journeys to Bedford previous to Show				7	3	6
Gratuities to Post-Office Officials, 10*l.* 10*s.*; Messenger, 5*l.* 6*s.* 8*d.*				15	16	8
Hire of Clock, &c.				16	17	0
Enamelling Dials of Turnstiles				11	8	9
Disinfectants, 1*l.* 11*s.* 2*d.*; Petty Payments, 7*l.* 9*s.* 7*d.*				9	0	9
Rosettes, 16*l.* 3*s.* 2*d.*; Medals, 20*l.* 2*s.*				36	5	2
Prizes: Stock, 3395*l.**; Implements, 425*l.*				3,820	0	0
				£16,215	18	1

* Exclusive of Local Prizes, 265*l.*; Suffolk Prizes, 35*l.*; and 90*l.* given by E. Pease, Esq.

Taunton Meeting, 1875:

ON MONDAY THE 12TH OF JULY, AND FOUR FOLLOWING DAYS.

SCHEDULE OF PRIZES.

I.—Live-Stock Prizes.

*Prizes offered by the Taunton Local Committee are marked thus *; those offered by Edward Pease, Esq., of Darlington, are marked thus †.*

Reference Number in Certificates.	HORSES.	First Prize.	Second Prize.	Third Prize.
Class	STALLIONS.	£.	£.	£.
1	Agricultural Stallion, foaled in the year 1873, *not qualified to compete as Clydesdale or Suffolk* ..	20	10	5
2	Agricultural Stallion, foaled before 1st Jan. 1873, *not qualified to compete as Clydesdale or Suffolk*	20	10	5
3	Clydesdale Stallion, foaled in the year 1873 ..	20	10	5
4	Clydesdale Stallion, foaled before the 1st Jan. 1873	20	10	5
5	Suffolk Stallion, foaled in the year 1873	20	10	5
6	Suffolk Stallion, foaled before the 1st of Jan. 1873	20	10	5
7	Thorough-bred Stallion, suitable for getting Hunters	50	20	10
8	Stallion, suitable for getting Hackneys	20	10	5
9	Pony Stallion	20	10	5
	BROOD MARES AND AGRICULTURAL FILLIES.			
10	Agricultural Mare, in foal, or with foal at foot, *not qualified to compete as Clydesdale or Suffolk* ..	20	10	5
11	Clydesdale Mare, in foal, or with foal at foot ..	20	10	5
12	Suffolk Mare, in foal, or with foal at foot	20	10	5
13	Agricultural Filly (*including Clydesdale and Suffolk*), two years old	15	10	5
14	Agricultural Filly (*including Clydesdale and Suffolk*), three years old	15	10	5
15	Mare, in foal, or with foal at foot, suitable for breeding Hunters	20	10	5
16	Mare, in foal, or with foal at foot, suitable for breeding Hackneys	20	10	5
17	Pony Mare, in foal, or with foal at foot, not exceeding 14 hands	15	10	5
	HUNTERS.			
18	Hunter Filly, two years old	15	10	..
19	Hunter Mare, three years old	15	10	..

Reference Number in Certificates.	HORSES—*continued.*	First Prize.	Second Prize.	Third Prize.
Class		£.	£.	£.
20	Hunter Mare, four years old	25	15	10
21	Hunter Gelding, four years old	25	15	10
22	Hunter Mare or Gelding, five years old and upwards, up to not less than 12 stone	30	20	10
23	Hunter Mare or Gelding, five years old and upwards, up to not less than 14 stone	30	20	10
	HACKNEYS.			
24	Hackney Mare or Gelding, up to not less than 12 stone	15	10	5
25	Hackney Mare or Gelding, up to not less than 14 stone	15	10	5
	PONIES.			
26	Pony Mare or Gelding, above 13 hands, and not exceeding 14 hands	15	10	5
27	Pony Mare or Gelding, not exceeding 13 hands ..	15	10	5
28	Jackass, not under 13 hands, for getting Mules for Agricultural purposes	25†	15†	10†
29	Mule, not under 15 hands, for Agricultural purposes	25†	15†	10†
	No Third Prize will be given unless at least Six animals be exhibited, and no Second Prize will be given unless at least Three animals be exhibited, except on the special recommendation of the Judges.			

CATTLE,

(ALL AGES CALCULATED TO JULY 1ST, 1875.)

	SHORTHORN.			
30	Bull, above three years old	20	10	5
31	Bull, above two and not exceeding three years old	20	10	5
32	Yearling Bull, above one and not exceeding two years old	20	10	5
33	Bull-Calf, above six and not exceeding twelve months old	15	10	5
34	Cow, above three years old	20	10	5
35	Heifer, in-milk or in-calf, not exceeding three years old	20	10	5

Reference Number in Certificates.	CATTLE—*continued.*	First Prize.	Second Prize.	Third Prize.
Class		£.	£.	£.
36	Yearling Heifer, above one and not exceeding two years old	15	10	5
37	Heifer-Calf, above six and under twelve months old	15	10	5
	HEREFORD.			
38	Bull, above three years old	20	10	5
39	Bull, above two and not exceeding three years old	20	10	5
40	Yearling Bull, above one and not exceeding two years old	20	10	5
41	Bull-Calf, above six and not exceeding twelve months old	10	5	..
42	Cow, above three years old	20	10	5
43	Heifer, in-milk or in-calf, not exceeding three years old	15	10	5
44	Yearling Heifer, above one and not exceeding two years old	15	10	5
45	Heifer-Calf, above six and under twelve months old	10	5	..
	DEVON.			
46	Bull, above three years old	20	10	5
47	Bull, above two and not exceeding three years old	20	10	5
48	Yearling Bull, above one and not exceeding two years old	20	10	5
49	Bull-Calf, above six and not exceeding twelve months old	10	5	..
50	Cow, above three years old	20	10	5
51	Heifer, in-milk or in-calf not exceeding three years old	15	10	5
52	Yearling Heifer, above one and not exceeding two years old	15	10	5
53	Heifer-Calf, above six and under twelve months old	10	5	..
	JERSEY.			
54	Bull, above two years old	15	10	5
55	Bull, above one year old and not exceeding two ..	15	10	5
56	Cow, above three years old	15	10	5
57	Heifer, in-milk or in-calf, not exceeding three years old	15	10	5
	GUERNSEY.			
58	Bull, above one year old	10	5	..
59	Cow, above three years old	10	5	..
60	Heifer, in-milk or in-calf, not exceeding three years old	10	5	..

Reference Number in Certificates.	CATTLE—*continued.*	First Prize.	Second Prize.	Third Prize.
Class		£.	£.	£.
	SUSSEX.			
61	Bull, above two years old	15	10	..
62	Bull, above one year old and not exceeding two ..	15	10	..
63	Cow, above three years old	15	10	..
64	Heifer, in-milk or in-calf, above two years old and not exceeding three	15	10	..
	No Third Prize will be given unless at least Six animals be exhibited, and no Second Prize will be given unless at least Three animals be exhibited, except on the special recommendation of the Judges.			
	SHEEP.			
	LEICESTER.			
65	Shearling Ram	20	10	5
66	Ram of any other age	20	10	5
67	Pen of Five Shearling Ewes, of the same flock ..	15	10	5
	COTSWOLD.			
68	Shearling Ram	20	10	5
69	Ram of any other age	20	10	5
70	Pen of Five Shearling Ewes, of the same flock ..	15	10	5
	LINCOLNS.			
71	Shearling Ram	20	10	5
72	Ram of any other age	20	10	5
73	Pen of Five Shearling Ewes, of the same flock ..	15	10	5
	OXFORDSHIRE DOWN.			
74	Shearling Ram	20	10	5
75	Ram of any other age	20	10	5
76	Pen of Five Shearling Ewes, of the same flock ..	15	10	5
	SOUTHDOWN.			
77	Shearling Ram	20	10	5
78	Ram of any other age	20	10	5
79	Pen of Five Shearling Ewes, of the same flock ..	15	10	5

Reference Number in Certificates.	SHEEP—*continued.*	First Prize.	Second Prize.	Third Prize.
Class		£.	£.	£.
	SHROPSHIRE.			
80	Shearling Ram	20	10	5
81	Ram of any other age	20	10	5
82	Pen of Five Shearling Ewes, of the same flock ..	15	10	5
	HAMPSHIRE AND OTHER SHORT-WOOLLED BREEDS.			
	Not qualified to compete as Southdown or Shropshire.			
83	Shearling Ram	20	10	5
84	Ram of any other age	20	10	5
85	Pen of Five Shearling Ewes, of the same flock ..	15	10	5
	SOMERSET AND DORSET HORNED.			
86	Shearling Ram	10	5	..
87	Ram of any other age	10	5	..
88	Pen of Five Shearling Ewes, of the same flock ..	10	5	..
	DARTMOOR.			
89	Shearling Ram	10	5	..
90	Ram of any other age	10	5	..
91	Pen of Five Shearling Ewes, of the same flock ..	10	5	..
	EXMOOR.			
92	Shearling Ram	10	5	..
93	Ram of any other age	10	5	..
94	Pen of Five Shearling Ewes, of the same flock ..	10	5	..
	DEVON LONG WOOL.			
95	Shearling Ram	10*	5*	..
96	Ram of any other age	10*	5*	..
97	Pen of Five Shearling Ewes, of the same flock ..	10*	5*	..
	No Third Prize will be given unless at least Six animals be exhibited, and no Second Prize will be given unless at least Three animals be exhibited, except on the special recommendation of the Judges.			

eference mber in tificates.	PIGS.	First Prize.	Second Prize.	Third Prize.
Class		£.	£.	£.
	LARGE WHITE BREED.			
98	Boar, above six months and not exceeding twelve months old	10	5	..
99	Boar, above twelve months old	10	5	..
100	Pen of three Breeding Sow-Pigs of the same litter, above four and under eight months old	10	5	..
101	Breeding Sow	10	5	..
	SMALL WHITE BREED.			
102	Boar, above six months and not exceeding twelve months old	10	5	..
103	Boar, above twelve months old	10	5	..
104	Pen of three Breeding Sow-Pigs of the same litter, above four and under eight months old	10	5	..
105	Breeding Sow	10	5	..
	SMALL BLACK BREED.			
106	Boar, above six months and not exceeding twelve months old	10	5	..
107	Boar, above twelve months old	10	5	..
108	Pen of three Breeding Sow-Pigs of the same litter, above four and under eight months old..	10	5	..
109	Breeding Sow	10	5	..
	BERKSHIRE BREED.			
110	Boar, above six months and not exceeding twelve months old	10	5	..
111	Boar, above twelve months old	10	5	..
112	Pen of three Breeding Sow-Pigs of the same litter, above four and under eight months old	10	5	..
113	Breeding Sow	10	5	..
	OTHER BREEDS.			
	Not eligible to compete in any of the preceding Classes.			
114	Boar, above six months and not exceeding twelve months old	10	5	..
115	Boar, above twelve months old	10	5	..
116	Pen of three Breeding Sow-Pigs of the same litter above four and under eight months old	10	5	..
117	Breeding Sow	10	5	..
	No Third Prize will be given unless at least Six animals be exhibited, and no Second Prize will be given unless at least Three animals be exhibited, except on the special recommendation of the Judges.			

Reference Number in Certificates.		First Prize.	Second Prize.
Class	LONG WOOL.	£.	£.
118	Six Fleeces	5*	3*
	BUTTER.		
119	Six Pounds made up in pounds	5*	3*
	CHEESE.		
120	Over 6 inches thick, not less than 1 cwt...	5*	3*
121	Under 6 inches thick and not less than 56 lbs. ..	5*	3*

II.—IMPLEMENT AND MACHINERY PRIZES OFFERED BY THE SOCIETY.

Class		£
1.	For the best One-horse Mowing Machine	20
	For the second best ditto	10
	For the third best ditto	5
	(The power for One-horse Machines not to exceed 33,000 foot-pounds per minute.)	
2.	For the best Two-horse Mowing Machine	30
	For the second best ditto	20
	For the third best ditto	10
3.	For the best Haymaking Machine	20
	For the second best ditto	10
	For the third best ditto	5
4.	For the best Self-acting Horse-Rake	15
	For the second best ditto	10
5.	For the best Horse-Rake, not self-acting	15
	For the second best ditto	10
6.	For the best system of Drying Hay in wet weather, sufficiently economical for practical purposes	Large Gold Medal.
	For the second best ditto	Large Silver Medal.

SPECIAL PRIZES.

A.	For the best guard or appliance to the Drum of a Threshing-Machine for preventing accidents to the people employed	20
	For the second best ditto	10
B.	For the best combined Guard and Feeder to the Drum of a Threshing-Machine	20
	For the second best ditto	10
	Miscellaneous Awards to Agricultural Articles, and essential improvements therein	Ten Silver Medals.

CONDITIONS APPLYING TO CERTAIN CLASSES OF LIVE STOCK ONLY.

Cattle.

1. No bull above two years old will be eligible for a prize unless certified to have served not less than three different cows (or heifers) within the three months preceding the 1st of June in the year of the Show.

2. All bulls above one year old shall have rings or "bull-dogs" in their noses, and be provided with leading sticks.

3. No cow will be eligible for a prize unless certified either at the date of entry or between the date of entry and that of the Show, to have had a living calf, or that the calf, if dead, was born at its proper time, within the twelve months preceding the date of the Show. Every Cow of the Channel Island breeds entered as in-milk shall be milked dry on the evening preceding the Show, in the presence of an officer of the Society, specially appointed for the purpose.

4. No heifer, entered as in-calf, will be eligible for a prize unless she is certified to have been bulled before the 31st of March in the year of the Show, nor will her owner afterwards receive the prize until he shall have furnished the Secretary with a further certificate before the 31st of January in the subsequent year, that she produced a living calf; or that the calf, if dead, was born at its proper time.

5. Shorthorns.—Each animal entered in the Shorthorn Classes must be certified by the Exhibitor to have not less than four crosses of Shorthorn blood which are, or are eligible to be, registered in the herd book.

Horses.

6. All foals must be the offspring of the mare along with which they are exhibited; and the sire of the foal must be given on the certificate of entry.

7. No mare entered in the classes for breeding animals will be eligible for a prize unless certified either at the date of entry, or between the date of entry and that of the Show, to have had a living foal—or that the foal, *if dead*, was born at its proper time, in the year of the Show;—or in the event of a mare being exhibited *without* a foal at foot, a certificate shall be produced at the time of entry of her having been served, and the prize shall be withheld till a certificate be produced of her having produced a foal.

8. No veterinary inspection of horses will be required except when considered necessary by the Judges, who will be accompanied by the Veterinary Inspectors.

9. Hunters and Hackneys entered to compete in the light-weight classes will be disqualified if, in the opinion of the Judges, they are eligible to compete in the heavy-weight classes.

10. A charge of 1*l.* for the accommodation of a horse-box, in addition to the entry-fee, will be made for each entry for stallions and mares in-foal, or with foals at foot.

11. A charge of 10*s.* will be made, in addition to the entry-fee, for the accommodation of a stall for each animal in the other Horse Classes.

Sheep.

12. All rams, except shearlings, must have been used in the preceding year.

13. Sheep exhibited for any of the prizes must have been *really and fairly shorn bare* after the 1st of April in the year of the Exhibition; and the date of such shearing must form part of the Certificate of Entry. Inspectors will be appointed by the Council to examine the sheep on their admission to the Show-Yard, with instructions to report to the Stewards any cases in which the sheep have not been *really and fairly shorn bare.*

14. Sheep unfairly prepared for Show by oiling or colouring will be disqualified on the recommendation of the Inspectors of Shearing.

Pigs.

15. The three sow-pigs in each pen must be of the same litter.

16. The breeding sows in Classes 101, 105, 109, 113, and 117, shall be certified to have had a litter of live pigs within the six months preceding the Show, or to be in-pig at the time of entry, so as to produce a litter before the 1st of September following. In the case of in-pig sows, the prize will be withheld until the Exhibitor shall have furnished the Secretary with a certificate of farrowing, as above.

17. No sow, if above eighteen months old, that has not produced a litter of live pigs, shall be eligible to compete in any of the classes.

18. The Judges of pigs will be instructed, with the sanction of the Stewards, to withhold prizes from any animals which shall appear to them to have been entered in a wrong class.

19. All pigs exhibited at the Country Meetings of the Society shall be subjected to an examination of their mouths by the Veterinary Inspector of the Society; and should the state of dentition in any pig indicate that the age of the animal has not been correctly returned in the Certificate of Entry, the Stewards shall have power to disqualify such pig, and shall report the circumstance to the Council at its ensuing Monthly Meeting. Every Pig which shall be found on examination by the Inspector to be oiled or coloured will be disqualified for competition and removed from the Show-Yard; as well as any Pig which shall be oiled or coloured while in the Show-Yard.

20. If a litter of pigs be sent with a breeding sow, the young pigs must be the produce of the sow, and must not exceed two months old.

RULES OF ADJUDICATION.

1. As the object of the Society in giving prizes for cattle, sheep, and pigs, is to promote improvement in *breeding* stock, the Judges in making their awards will be instructed not to take into their consideration the present value to the butcher of animals exhibited, but to decide according to their relative merits for the purpose of *breeding*.

2. If, in the opinion of the Judges, there should be equality of merit, they will be instructed to make a special report to the Council, who will decide on the award.

3. The Judges will be instructed to withhold any prize if they are of opinion that there is not sufficient merit in any of the stock exhibited for such prize to justify an award.

4. The Judges will be instructed to give in a *Reserved Number* in each class of live stock; viz., which animal would, in their opinion, possess sufficient merit for the prize, in case the animal to which the prize is awarded should subsequently become disqualified.

5. In the classes for stallions, mares, and fillies, the Judges in awarding the prizes will be instructed, in addition to symmetry, to take activity and strength into their consideration.

6. The attention of the Stewards and Judges is particularly called to the conditions applying to pigs. The Senior Steward of Live Stock is requested to report any malpractices on the part of Exhibitors, and any person found guilty will not be allowed to exhibit at future meetings of the Society.

CONDITIONS RELATING TO IMPLEMENTS.

Conditions of Trial.

1. Such implements as the Judges may direct will be tested for draught by means of the new horse-dynamometer, which was used in the cart and waggon trials at Bedford, and which is fully described in the last number of the Society's 'Journal,' Second Series, vol. x., pages 679–682.

2. For this purpose, all mowing-machines must be provided with one pair of shafts, into which the dynamometer can be yoked by means of its harness, which represents ordinary cart-harness. A mowing-machine under Trial for draught must be drawn by means of that pair of shafts alone.

3. These shafts will be treated as special appliances for facilitating the Trials, in cases in which they are not usually supplied with the machines.

4. The Trials of mowing-machines will be directed to test the qualities of the implements under conditions as various as the season and the state of the crops in the Trial-fields will permit.

5. In Class 6, the drying powers of an apparatus will be ascertained by noting the time required for the treatment of a given weight of green hay, and the weight of moisture removed from it during treatment. For economy, these results will be further compared with the consumption of fuel or power required for effecting the work.

DATES OF ENTRY FOR LIVE STOCK AND IMPLEMENTS.

Certificates for the entry of Implements for the Taunton Meeting must be forwarded to the Secretary of the Society, No. 12, Hanover Square, London, W., by the 1st of May, and Certificates for the entry of Live Stock by the 1st of June. Certificates received after those respective dates will not be accepted, but returned to the persons by whom they have been sent.

The Prizes of the Royal Agricultural Society of England, and all Prizes offered by the Taunton Local Committee, and other Donors, are open to general competition.

⁎ Forms of Certificate for entry, as well as Prize-Sheets for the Taunton Meeting, containing the whole of the conditions and regulations, may be obtained at the Office of the Society, No. 12, Hanover Square, London, W.

Members' Veterinary Privileges.

I.—Serious or Extensive Diseases.

No. 1. Any Member of the Society who may desire professional attendance and special advice in cases of serious or extensive disease among his cattle, sheep, or pigs, and will address a letter to the Secretary, will, by return of post, receive a reply stating whether it be considered necessary that Professor Simonds, the Society's Veterinary Inspector, should visit the place where the disease prevails.

No. 2. The remuneration of the Inspector will be 2*l.* 2*s.* each day as a professional fee, and 1*l.* 1*s.* each day for personal expenses; and he will also be allowed to charge the cost of travelling to and from the locality where his services may have been required. The fees will be paid by the Society, but the travelling expenses will be a charge against the applicant. This charge may, however, be reduced or remitted altogether at the discretion of the Council, on such step being recommended to them by the Veterinary Committee.

No. 3. The Inspector, on his return from visiting the diseased stock, will report to the Committee, in writing, the results of his observations and proceedings, which Report will he laid before the Council.

No. 4. When contingencies arise to prevent a personal discharge of the duties confided to the Inspector, he may, subject to the approval of the Committee, name some competent professional person to act in his stead, who shall receive the same rates of remuneration.

II.—Ordinary or Other Cases of Disease.

Members may obtain the attendance of the Veterinary Inspector on any case of disease by paying the cost of his visit, which will he at the following rate, viz., 2*l.* 2*s.* per diem, and travelling expenses.

III.—Consultations without Visit.

Personal consultation with Veterinary Inspector	5*s.*
Consultation by letter	5*s.*
Consultation necessitating the writing of three or more letters	10*s.*
Post-mortem examination, and report thereon	10*s.*

A return of the number of applications during each half-year being required from the Veterinary Inspector.

IV.—Admission of Diseased Animals to the Veterinary College; Investigations; Lectures, and Reports.

No. 1. All Members of the Society have the privilege of sending cattle, sheep, and pigs to the Infirmary of the Royal Veterinary College, on the same terms as if they were Members of the College; viz., by paying for the keep and treatment of cattle 10*s.* 6*d.* per week each animal, and for sheep and pigs "a small proportionate charge to be fixed by the Principal according to circumstances."

No. 2. The College has also undertaken to investigate such particnlar classes of disease, or special subjects connected with the application of the Veterinary art to cattle, sheep, and pigs, as may be directed by the Council.

No. 3. In addition to the increased number of lectures now given by Professor Simonds—the Lecturer on Cattle Pathology—to the pupils in the Royal Veterinary College, he will also deliver such lectures before the Members of the Society, at their house in Hanover Square, as the Council shall decide.

No. 4. The Royal Veterinary College will authorize their Principal to furnish to the Council quarterly a detailed Report of the cases of cattle, sheep, and pigs treated in the Infirmary; and also special reports from time to time on any matter of unusual interest which may come under the notice of the College.

By Order of the Council,

H. M. JENKINS, *Secretary.*

Members' Privileges of Chemical Analysis.

The Council have fixed the following rates of Charge for Analyses to be made by the Consulting Chemist for the *bonâ fide* use of Members of the Society; who (to avoid all unnecessary correspondence) are particularly requested, when applying to him, to mention the kind of analysis they require, and to quote its number in the subjoined schedule. The charge for analysis, together with the carriage of the specimens, must be paid to him by members at the time of their application.

No. 1.—An opinion of the genuineness of Peruvian guano, bone-dust, or oil-cake (each sample)	5*s*.
,, 2.—An analysis of guano; showing the proportion of moisture, organic matter, sand, phosphate of lime, alkaline salts, and ammonia	10*s*.
,, 3.—An estimate of the value (relatively to the average of samples in the market) of sulphate and muriate of ammonia, and of the nitrates of potash and soda	10*s*.
,, 4.—An analysis of superphosphate of lime for soluble phosphates only	10*s*.
,, 5.—An analysis of superphosphate of lime, showing the proportions of moisture, organic matter, sand, soluble and insoluble phosphates, sulphate of lime, and ammonia ..	£1.
,, 6.—An analysis (sufficient for the determination of its agricultural value) of any ordinary artificial manure	£1.
,, 7.—Limestone:—the proportion of lime, 7s. 6*d*.; the proportion of magnesia, 10*s*.; the proportion of lime and magnesia	15*s*.
,, 8.—Limestone or marls, including carbonate, phosphate, and sulphate of lime, and magnesia with sand and clay ..	£1.
,, 9.—Partial analysis of a soil, including determinations of clay, sand, organic matter, and carbonate of lime	£1.
,, 10.—Complete analysis of a soil	£3.
,, 11.—An analysis of oil-cake, or other substance used for feeding purposes; showing the proportion of moisture, oil, mineral matter, albuminous matter, and woody fibre; as well as of starch, gum, and sugar, in the aggregate	£1.
,, 12.—Analyses of any vegetable product	£1.
,, 13.—Analyses of animal products, refuse substances used for manure, &c.	from 10*s*. to 30*s*.
,, 14.—Determination of the "hardness" of a sample of water before and after boiling	10*s*.
,, 15.—Analysis of water of land drainage, and of water used for irrigation	£2.
,, 16.—Determination of nitric acid in a sample of water	£1.

N.B.—*The above Scale of Charges is not applicable to the case of persons commercially engaged in the Manufacture or Sale of any Substance sent for Analysis.*

The Address of the Consulting Chemist of the Society is, Dr. Augustus Voelcker, F.R.S., 11, Salisbury Square, London, E.C., to which he requests that all letters and parcels (Postage and Carriage paid) should be directed.

By Order of the Council,

H. M. JENKINS, *Secretary*.

INSTRUCTIONS FOR SELECTING AND SENDING SAMPLES FOR ANALYSIS.

ARTIFICIAL MANURES.—Take a large handful of the manure from three or four bags, mix the whole on a large sheet of paper, breaking down with the hand any lumps present, and fold up in tinfoil, or in oil silk, about 3 oz. of the well-mixed sample, and send it to 11, SALISBURY SQUARE, FLEET STREET, E.C., by post: or place the mixed manure in a small wooden or tin box, which may be tied by string, but must not be sealed, and send it by post. If the manure be very wet and lumpy, a larger boxful, weighing from 10 to 12 oz., should be sent either by post or railway.

Samples not exceeding 4 oz. in weight may be sent by post, by attaching two penny postage stamps to the parcel.

Samples not exceeding 8 oz., for three postage stamps.

Samples not exceeding 12 oz., for four postage stamps.

The parcels should be addressed: DR. AUGUSTUS VOELCKER, 11, SALISBURY SQUARE, FLEET STREET, LONDON, E.C., and the address of the seuder or the number or mark of the article be stated on parcels.

The samples may be sent in covers, or in boxes, bags of linen or other materials. No parcel sent by post must exceed 12 oz. in weight, 1 foot 6 inches in length, 9 inches in width, and 6 inches in depth.

SOILS.—Have a wooden box made 6 inches long and wide, and from 9 to 12 inches deep, according to the depth of soil and subsoil of the field. Mark out in the field a space of about 12 inches square; dig round in a slanting direction a trench, so as to leave undisturbed a block of soil with its subsoil from 9 to 12 inches deep; trim this block or plan of the field to make it fit into the wooden box, invert the open box over it, press down firmly, then pass a spade under the box and lift it up, gently turn over the box, nail on the lid and send it by goods or parcel to the laboratory. The soil will then be received in the exact position in which it is found in the field.

In the case of very light, sandy, and porous soils, the wooden box may be at once inverted over the soil and forced down by pressure, and then dug out.

WATERS.—Two gallons of water are required for analysis. The water, if possible, should be sent in glass-stoppered Winchester half-gallon bottles, which are readily obtained in any chemist and druggist's shop. If Winchester bottles cannot be procured, the water may be sent in perfectly clean new stoneware spirit-jars surrounded by wickerwork. For the determination of the degree of hardness before and after boiling, only one quart wine-bottle full of water is required.

LIMESTONES, MARLS, IRONSTONES, AND OTHER MINERALS.—Whole pieces, weighing from 3 to 4 oz., should be sent enclosed in small linen bags, or wrapped in paper. Postage 2*d.*, if under 4 oz.

OILCAKES.—Take a sample from the middle of the cake. To this end break a whole cake into two. Then break off a piece from the end where the two halves were joined together, and wrap it in paper, leaving the ends open, and send parcel by post. The piece should weigh from 10 to 12 oz. Postage, 4*d.* If sent by railway, one quarter or half a cake should be forwarded.

FEEDING MEALS.—About 3 oz. will be sufficient for analysis. Enclose the meal in a small linen bag. Send it by post.

On forwarding samples, separate letters should be sent to the laboratory specifying the nature of the information required, and, if possible, the object in view.

H. M. JENKINS, *Secretary.*

Members' Botanical Privileges.

The Council have provisionally fixed the following Rates of Charge for the examination of Plants and Seeds for the *bonâ fide* use of Members of the Society, who are particularly requested, when applying to the Consulting Botanist, to mention the kind of examination they require, and to quote its number in the subjoined Schedule. The charge for examination must be paid to the Consulting Botanist at the time of application, and the carriage of all parcels must be prepaid.

No. 1.—A general opinion as to the genuineness and age of a sample of clover-seed (each sample)	5*s*.
,, 2.—A detailed examination of a sample of dirty or impure clover-seed, with a report on its admixture with seeds of dodder or other weeds (each sample)	10*s*.
,, 3.—A test examination of turnip or other cruciferous seed, with a report on its germinating power, or its adulteration with 000 seed (each sample)	10*s*.
,, 4.—A test examination of any other kind of seed, or corn, with a report on its germinating power (each sample) ..	10*s*.
,, 5.—Determination of the species of any indigenous British plant (not parasitic), with a report on its habits (each species)	5*s*.
,, 6.—Determination of the species of any epiphyte or vegetable parasite, on any farm-crop grown by the Member, with a report on its habits, and suggestions (where possible) as to its extermination or prevention (each species) ..	10*s*.
,, 7.—Report on any other form of plant-disease not caused by insects	10*s*.
,, 8.—Determination of the species of a collection of natural grasses indigenous to any district ou one kind of soil (each collection)	10*s*.

INSTRUCTIONS FOR SELECTING AND SENDING SAMPLES.

In sending seed or corn for examinatiou the utmost care must be taken to secure a fair and honest sample. If anything supposed to be injurious or useless exists in the corn or seed, selected samples should also be sent.

In collecting specimens of plants, the whole plant should be taken up, and the earth shaken from the roots. If possible, the plants must be in flower or fruit. They should be packed in a light box, or in a firm paper parcel.

Specimens of diseased plants or of parasites should be forwarded as fresh as possible. Place them in a bottle, or pack them in tin-foil or oil-silk.

All specimens should be accompanied with a letter specifying the nature of the information required, and stating any local circumstances (soil, situation, &c.) which, in the opinion of the sender, would be likely to throw light on the inquiry.

N.B.—*The above Scale of Charges is not applicable in the case of Seedsmen requiring the services of the Consulting Botanist.*

Parcels or letters (Carriage or Postage prepaid) to be addressed to Mr. W. Carruthers, F.R.S., 25, Wellington Street, Islington, London.

H. M. JENKINS, *Secretary.*

Royal Agricultural Society of England.

1875.

President.

LORD CHESHAM.

Trustees.

Year when Elected.

1855 Acland, Sir Thomas Dyke, Bart., M.P., *Sprydoncote, Exeter, Devonshire.*
1857 Bridport, Viscount, *Cricket St. Thomas, Chard, Somersetshire.*
1850 Chesham, Lord, *Latimer, Chesham, Bucks.*
1861 Dent, J. D., *Ribston Hall, Wetherby, Yorkshire.*
1863 Kingscote, Colonel, M.P., *Kingscote, Wootton-under-Edge, Gloucestershire.*
1868 Lichfield, Earl of, *Shugborough, Staffordshire.*
1854 Macdonald, Sir Archibald Keppel, Bt., *Woolmer Lodge, Liphook, Hants.*
1860 Marlborough, Duke of, K.G., *Blenheim Park, Oxford.*
1846 Milward, Richard, *Thurgarton Priory, Southwell, Notts.*
1839 Portman, Viscount, *Bryanston, Blandford, Dorset.*
1856 Powis, Earl of, *Powis Castle, Welshpool, Montgomeryshire.*
1858 Rutland, Duke of, K.G., *Belvoir Castle, Grantham, Leicestershire.*

Vice-Presidents.

1873 Bedford, Duke of, *Woburn Abbey, Bedfordshire.*
1861 Cathcart, Earl, *Thornton-le-Street, Thirsk, Yorkshire.*
1839 Chichester, Earl of, *Stanmer Park, Lewes, Sussex.*
1867 Devonshire, Duke of, K.G., *Holker Hall, Lancashire.*
1847 Eversley, Viscount, *Heckfield Place, Winchfield, Hants.*
1848 Gibbs, B. T. Brandreth, *Halfmoon Street, Piccadilly, London,* W.
1858 Kerrison, Sir Edward C., Bart., *Brome Hall, Scole, Suffolk.*
1839 Miles, Sir William, Bart., *Leigh Court, Bristol, Somersetshire.*
1852 Richmond, Duke of, K.G., *Goodwood, Chichester, Sussex.*
1859 Vernon, Lord, *Sudbury Hall, Derby.*
1861 Wells, William, *Holmewood, Peterborough, Northamptonshire.*
1855 Wynn, Sir Watkin Williams, Bart., M.P., *Wynnstay, Ruabon, Denbighshire.*

Other Members of Council.

1858 Amos, Charles Edwards, 5, *Cedars Road, Clapham Common, Surrey.*
1875 Aveling, Thomas, *Rochester, Kent.*
1875 Aylmer, Hugh, *West Dereham, Stoke Ferry, Norfolk.*
1848 Barnett, Charles, *Stratton Park, Biggleswade, Bedfordshire.*
1868 Booth, Thomas Christopher, *Warlaby, Northallerton, Yorkshire.*
1863 Bowly, Edward, *Siddington House, Cirencester, Gloucestershire.*
1861 Cantrell, Charles S., *Riding Court, Datchet, Bucks.*
1866 Davies, David Reynolds, *Agden Hall, Lymm, Cheshire.*
1860 Druce, Joseph, *Eynsham, Oxford.*
1868 Edmonds, William John, *Southrope, Lechlade, Gloucestershire.*

Year when Elected.	
1871	EGERTON, Hon. WILBRAHAM, M.P., *Rostherne Manor, Knutsford, Cheshire.*
1867	ESLINGTON, Lord, M.P., *Ravensworth Castle, Durham.*
1873	EVANS, JOHN, *Uffington, Shrewsbury, Salop.*
1875	FRANKISH, WILLIAM, *Limber Magna, Ulceby, Lincolnshire.*
1874	HEMSLEY, JOHN, *Shelton, Newark, Notts.*
1873	HORLEY, THOMAS, Jun., *The Fosse, Leamington, Warwickshire.*
1866	HORNSBY, RICHARD, *Spittle Gate, Grantham, Lincolnshire.*
1854	HOSKYNS, CHANDOS WREN, *Harewood, Ross, Herefordshire.*
1871	JONES, J. BOWEN, *Ensdon House, Shrewsbury, Salop.*
1848	LAWES, JOHN BENNET, *Rothamsted, St. Albans, Herts.*
1869	LEEDS, ROBERT, *Wicken Farm, Castleacre, Brandon, Norfolk.*
1872	LEICESTER, Earl of; K.G., *Holkham Hall, Wells, Norfolk.*
1874	LINDSAY, Colonel LOYD, M.P., *Lockinge Park, Wantage, Berkshire.*
1865	LOPES, Sir MASSEY, Bart., M.P., *Maristow, Roborough, Devon.*
1871	McINTOSH, DAVID, *Havering Park, Romford, Essex.*
1874	MARTIN, JOSEPH, *Highfield House, Littleport, Isle of Ely, Cambridgeshire.*
1871	MASFEN, R. HANBURY, *Pendeford, Wolverhampton, Staffordshire.*
1875	MUSGRAVE, SIR R. C., Bart., *Edenhall, Penrith, Cumberland.*
1857	PAIN, THOMAS, *The Grove, Basingstoke, Hants.*
1874	POLE-GELL, H. CHANDOS, *Hopton Hall, Wirksworth, Derbyshire.*
1861	RANDELL, CHARLES, *Chadbury, Evesham, Worcestershire.*
1871	RAWLENCE, JAMES, *Bulbridge, Wilton, Salisbury, Wilts.*
1869	RIDLEY, M. WHITE, M.P., *Blagdon, Cramlington, Northumberland.*
1861	RIGDEN, WILLIAM, *Hove, Brighton, Sussex.*
1875	RUSSELL, ROBERT, *Farningham, Dartford.*
1874	SANDAY, GEORGE HENRY, *Wensley House, Bedale, Yorkshire.*
1856	SHUTTLEWORTH, JOSEPH, *Hartsholme Hall, Lincoln.*
1872	SKELMERSDALE, Lord, *Lathom Hall, Ormskirk, Lancashire.*
1874	SPENCER, Earl, K.G., *Althorp, Northampton.*
1875	STRATTON, RICHARD, *The Duffryn, Newport, Monmouthshire.*
1873	TORR, JOHN, M.P., *Carlett Park, Eastham, Chester.*
1874	TURBERVILL, Major PICTON, *Ewenny Abbey, Bridgend, South Wales.*
1845	TURNER, GEORGE, *Brampford Speke, Exeter, Devonshire.*
1871	TURNER, JABEZ, *Haddon, Huntingdonshire.*
1871	WAKEFIELD, WILLIAM H., *Kendal, Westmoreland.*
1870	WELBY, Sir WILLIAM EARLE, Bart., M.P., *Newton House, Folkingham, Lincolnshire.*
1870	WHITEHEAD, CHARLES, *Barming House, Maidstone, Kent.*
1865	WILSON, JACOB, *Woodhorn Manor, Morpeth, Northumberland.*
1875	WORSLEY, W. CAYLEY, *Hovingham, York.*

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THE WHOLE COUNCIL.

*** The PRESIDENT, TRUSTEES, and VICE-PRESIDENTS are Members *ex officio* of all Committees.

Royal Agricultural Society of England.

GENERAL MEETING,

12, Hanover Square, Saturday, May 22nd, 1875.

REPORT OF THE COUNCIL.

In presenting their Annual Report to the Members of the Royal Agricultural Society the Council have to congratulate them on the large accession to the list of Members which has taken place during the five months which have elapsed since the General Meeting in December. In that period 8 Governors and 64 Members have died, the names of 25 Members have been removed from the list by order of the Council, in addition to those of 115 others who resigned their membership in the course of the year 1874. These losses have been more than counterbalanced by the election of 16 Governors and 359 Members, and the transfer of 16 Members to the list of Governors.

The Society now consists of:—

79 Life Governors,
79 Annual Governors,
2058 Life Members,
3918 Annual Members,
11 Honorary Members,

The total number of the Society is thus 6145, showing an increase of 24 Governors and 139 Members since the Half-yearly Meeting last December; and one of 24 Governors and 276 Members during the whole year which has elapsed since the Annual Meeting in May, 1874.

The Council regret that they have to record the great loss which the Society has sustained during the past half-year by the deaths of Lord Tredegar and Mr. Holland, Trustees and former Presidents of the Society, Lord Kesteven, a Trustee, and Mr. William Torr, of Aylesby, Lincolnshire, a most active and valuable Member of the Council.

The vacancies in the list of Trustees caused by the deaths of Lord Kesteven and Mr. Holland have been filled up by the

election of Sir T. Dyke Acland, Bart., M.P., and Mr. Dent; and the two vacancies in the Council which were reported at the General Meeting in December have been filled up by the election of Sir R. Musgrave, of Eden Hall, Penrith, and Mr. W. Frankish, of Limber Magna, Ulceby; while the elections of Mr. W. Cayley Worsley, of Hovingham, York; Mr. Hugh Aylmer, of West Dereham, Norfolk; and Mr. Robert Russell, of Horton Kirby, Kent, have filled the vacancies caused by the death of Mr. Torr, and the transfer of two Members of the Council to the list of Trustees.

The vacancy caused by the death of Lord Tredegar will probably be filled up in June.

The accounts for the year 1874 have been examined and certified by the auditors and accountants of the Society, and have been published in the last number of the 'Journal,' together with the statement of receipt and expenditure connected with the Country-meeting at Bedford. The net deficiency of those receipts, as compared with the expenditure, was 3717*l.*, to meet which the Council have applied the surplus ordinary income of the year, in addition to the sum realised by the sale of 3000*l.* New Three per Cents. previous to the General Meeting in December. The funded capital of the Society now stands at 21,112*l.* 7*s.* 8*d.* New Three per Cents.; and the following sums were, on the 1st instant, in the hands of the bankers, available for the ordinary purposes of this Society and towards defraying the expenses of the forthcoming Taunton Meeting, namely, on deposit 1500*l.*, and balance of the current account 3321*l.* 0*s.* 5*d.*

The receipts at the Country Meetings of the Society having proved for several years in succession inadequate to meet the expenditure, to an extent which has caused a diminution of 6300*l.* in the Society's capital in the course of five years, the Finance Committee have specially brought this matter under the notice of the Council, particularly with reference to the cost of the Trials of Implements. After an extended investigation and much discussion, the Council have resolved that the Implement Trials shall still take place annually; but that the list of classes of implements to be tried, in addition to new inventions which may be tried in any year, shall for the present be confined to the following:—Double-furrow ploughs, root-thinners, manure-distributors, mowing-machines, horse-rapes, haymakers, reaping-machines, sheaf-binders, stacking-machines, stone-

breakers, thatchmaking-machines, steam-cultivating machinery, agricultural locomotives, and waggons suitable for agricultural locomotives. They have also resolved that the trials of mowing and haymaking-machines which will take place this year at Taunton, shall be followed by a trial of reaping-machines and sheaf-binders at a proper season next year. By this arrangement the Council hope to lessen the expense to the Society without diminishing the usefulness of the trials, as the classes of implements which have been excluded from the list are those in which no further improvement of importance is at present probable, unless it be of such a nature as to entitle the implement to a trial and award as a new invention. They also believe that the expenses of exhibition at the Society's Country Meetings will be materially reduced in those years, as in 1876, when the trials will not take place at the time of the Show, but at a more appropriate season.

The Council have received with much regret the resignation of Mr. Brandreth Gibbs as Honorary Director of the Society's Country Meetings, an office which he has held for upwards of thirty years, much to the advantage and interests of the Society, and the duties of which he has discharged with remarkable zeal and efficiency; and they have resolved that a suitable testimonial be presented to Mr. Brandreth Gibbs on his retirement from the office of Honorary Director, as a mark of the appreciation entertained by the Society of his valuable services in that position.

Mr. Gibbs's resignation has rendered it necessary to provide for the performance of the duties which he has so long and so ably discharged, by a division of the labour and responsibility involved; and the Council have resolved that the Secretary shall have charge of the additional office work; that the Surveyor shall be responsible for the final preparation of the implement and cattle sheds; that the Stewards of Implements, Live Stock, and Finance shall be responsible for the work of their several departments; and that there shall be a Steward of General Arrangements elected for three years, who will have the supervision of the entire Showyard, and act in concert with the Stewards of Departments, when appealed to by them, or when his assistance may be necessary. The Council have unanimously requested Mr. Jacob Wilson to undertake the duties of the office for the first time.

The district assigned for the Country Meeting in 1876 com-

prises the counties of Derby, Leicester, Lincoln, Northampton, Nottingham, Rutland, and Warwick. The Council having received most cordial invitations from the authorities of Birmingham, Lincoln, Nottingham, and Peterborough, appointed a Committee to inspect the sites and other accommodation offered by the respective localities; and after considering the Report of this Committee, and conferring with representatives of the several towns, finally decided that the Country Meeting for 1876 should be held at Birmingham.

The Council have also to announce that, in accordance with the rotation of districts at present followed, the Country Meeting for 1877 will be held in the district comprising the counties of Cumberland, Lancaster, Westmoreland, and the West Riding of Yorkshire.

The Council have obtained the opinion of T. C. Kingdon, Esq., Q.C., as to the proper interpretation of the language of the Charter and of the Bye-laws, more especially with reference to some apparent inconsistency between them respecting the powers of the Members of the Society. The full text of the case submitted to Mr. Kingdon and his opinion are added as an appendix to this Report; and the Council have now only to add that, after careful consideration of the opinion of Mr. Kingdon, they gave power to a Special Committee to re-consider those Bye-laws which are inconsistent with the Charter, and generally to revise the Bye-laws of the Society. The Bye-laws, as revised by the Committee, are at present under the consideration of the Society's solicitors, and it is proposed to enact the revised code in December in the manner laid down in the existing Bye-laws.

The Secretary of State for Foreign Affairs having communicated to the Council a correspondence between the Swiss Envoy at Vienna and Sir Andrew Buchanan, Her Majesty's Ambassador, relating to the alleged probable importation of the Colorado Potato-beetle into this country with American potatoes, this question has received the careful attention of the Botanical Committee during the past six months. They have ascertained that American potatoes are imported into this country (in comparatively small quantities, and for use as seed) during the months of November to March inclusive; and they have arranged for the publication of a paper on the subject in the next number of the 'Journal,' which will appear before the commencement of the next season of importation.

APPENDIX TO REPORT OF THE COUNCIL.

The Royal Agricultural Society of England.

ITS CONSTITUTION AND BYE-LAWS.

THE SOCIETY is incorporated by Royal Charter, dated on the 26th of March, 1840. Its Members being the then subscribers of the then existing "English Agricultural Society," or those "who should at any time thereafter become subscribers thereof according to such Regulations or Bye-laws as should be thereafter framed or enacted"—their number being indefinite, but classed according to their election or rate of payment, into Governors and Members—a principle of its constitution being the total exclusion of politics—"which no Resolution, Bye-law, or other enactment of the said Body Politic and Corporate shall on any account be allowed to infringe."

Clause 6 directs three General Meetings of the Society to be held annually—two in London, one in May and the other in December, and one in the country. At the May Meeting in London, the Governors and Members are empowered to elect a President and Council—consisting of one President, twelve Trustees, twelve Vice-Presidents elected from the Governors, and of fifty other Members elected indiscriminately from Governors and Members, twenty-five of the fifty going out by rotation each year, but being capable of re-election. "All vacancies in such offices by resignation, death, or otherwise, to be filled up by election, and the majority of votes of the remaining Members of such President and Council."

Clause 7 somewhat repeats Clause 6, granting to the May Meeting "full power and privilege of selecting the President Trustees, Vice-Presidents, and other Members of the Council, from the Governors and Members as aforesaid," "and that such President, Trustees, Vice-Presidents, and Council shall be regulated in their proceedings by such Bye-laws as may and shall from time to time be enacted by them conformably with the terms of the Charter." No established Bye-law, however, being in any case altered, or a new one proposed, without at least one month's notice of such intention being given to each Member of the Council, "and empowers the President and Council to appoint and remove a Secretary, responsible to them for the discharge of his duties as defined, from time to time, by their Bye-laws or Special Resolutions."

Clause 9 declares that the President and Council "shall have the sole management of the income and funds of the said Body Politic and Corporate, and also the entire management and superintendence of all the other affairs and concerns thereof, and shall or may, but not inconsistently with or contrary to the provisions of the Charter or any existing Bye-law or the laws or statutes of the realm, do all such acts and deeds as shall appear to them necessary or essential to be done for the purpose of carrying into effect the objects and views of the said Royal Agricultural Society of England."

Various Bye-laws and Regulations, or Resolutions, have been passed by the Council, which, with the Charter, have been printed for the use of Members.

(A print accompanies this Case.)

The Bye-laws Nos. 1, 5, 9, 13, 14, 15, 22, 23, 27, and 76, and Resolutions Nos. 1 and 4, are those more particularly to be referred to for the purposes of this Case.

The President, Vice-Presidents, and Trustees have hitherto been elected at the General Meetings in May by show of hands, and the twenty-five incoming Members of Council by Ballot of the Members then present (Bye-law 15). Members are elected and dismissed by the President and Council according to Bye-laws 1 and 9.

No Bye-laws have ever yet been passed at any of the General Meetings.

Nor have any Resolutions been passed at any of those Meetings in any way interfering with the past or present Bye-laws, or with the President and Council: Practically, the sole action of the Society, at the General Meetings, has been confined to the election of the President and Council, and receiving the Reports of the Council, and the whole government of the Society has been left to the President and Council, on the assumption that it is delegated to them by Clause 9 of the Charter.

And, on that assumption, all the existing Bye-laws and Resolutions have from the outset been accordingly passed by the President and Council alone.

Members at the General Meetings are invited to make suggestions on the Reports of the Council; but anything like a Resolution, at the instance of a Member, in any way tending to direct or control the Council, is at once stopped by the President as being *ultra vires.*

It would obviously be most inconvenient, in a body like the Society, to be without a governing head; or if any set of Members out of the Council could control or interfere with the action of that head by any Resolution which a mere section might contrive to carry at any General Meeting. The attendance of ordinary Members at the London Meetings—and particularly at the May Meetings—is very small, and Resolutions might easily be carried in that way. At the same time, it might be beneficial to the Society were the election of the President and Council not confined, as now, to the few Members present at the May Meetings, but were extended to the Members at large by voting by proxy. Such an extension would be an enlargement, and not a restriction, of the present right or practice.

Much discussion on this question, in connection with the relative status of the President and Council to the General Body has of late taken place in the Society, and hence the reason for the present Case.

In dealing with the subject it seems necessary to consider.

What powers are incident to the Corporate Body, as constituted by the Charter?

And what powers are specially conferred by it?

It is assumed that the Society would have the right to pass Resolutions and make Bye-laws, as incident to its incorporation, if such right be not displaced or negatived by the Charter itself.

Does the Charter therefore do the latter?

It no doubt (Clause 9) vests the sole management of the Society's property, and management and superintendence of its affairs, consistently with the provisions of the Charter and Bye-laws, in the President and Council, and (Clause 7) directs that the President and Council shall be regulated in their proceedings by the Bye-laws which they themselves may enact conformably with the Charter. But does this confer on the President and Council the absolute and sole right to make Bye-laws affecting the Society at large, or its Members individually, and in derogation of any general right otherwise incident to the Corporate Body? If so, the power of the Corporate Body in its Corporate entirety is then necessarily limited to the election of the President and Council as the governing and controlling head. And if not, then what other powers can the Society exercise?

It is assumed that, except in so far as the Charter itself invests the President and Council with special powers, the general incidental powers remain with the General Body; and that if those special powers, as vested in the

President and Council, are limited to general management according to existing Bye-laws, and to making, simply, Bye-laws to govern their own proceedings, and not Bye-laws to bind the Corporate Body at large, the Body can, nevertheless, by Resolutions or Bye-laws made by the Body, control the President and Council.

The contrary view has hitherto been the rule and practice of the Society.

Some of the Bye-laws, and especially Nos. 13 and 14, might perhaps be questionable, if the exclusive power be not vested in the President and Council; and Bye-laws 22 and 27 admit the right of the Society in General Meetings to control the President and Council, though in practice the exercise of such right has always been denied. The Bye-laws and Resolutions, generally, are in many respects inharmonious, and require revision. But before any revision is attempted, it should be clear who has the power to revise. Should any of those existing be invalid, for want of power in the President and Council, that informality might, it is assumed, be cured by a resolution of the General Body.

Having regard, however, to the above statements.

THE OPINION OF COUNSEL is desired :—

1st. As to the powers of the General Body, independently of, or to control, the President and Council.

2nd. As to the special powers of the President and Council, hitherto exercised, to act without reference to the General Body.

3rd. Whether the Charter precludes voting by proxy at General Meetings?

4th. If not, in what way the future voting by proxy may be effected?

5th. Whether any and which of the Bye-laws and Resolutions above specially referred to are beyond the powers of the President and Council, or contrary to the principles of the Society's Charter; and, if the former, how far they may be confirmed by the Resolutions of the General Body?

6th. And generally, as to any other of the Bye-laws or Resolutions, by reason of informality, inconsistency, or otherwise, calling for particular notice.

OPINION.

1st. I am of opinion that the General Body has no powers independently of, or to control, the President and Council. By the 9th Section of the Charter, the sole management of the funds of the Society, and the entire management and superintendence of its affairs, is vested in the President and Council, and by the 7th Section of the Charter, their powers are to be exercised in conformity with Bye-laws to be made by themselves; and I am of opinion that these provisions of the Charter impliedly exclude the General Body from making any Bye-law, or voting any Resolution to control the powers of the President and Council. The General Body may, indeed, I think, at any of the General Meetings, offer suggestions or recommendations for the guidance of the President and Council, but may not enforce them by voting any Resolution, or making any Bye-law, or by requiring the President and Council to make any Bye-laws to enforce them.

2nd. I am of opinion that the President and Council have the special powers hitherto exercised by them, to act without reference to the General Body.

3rd. I am of opinion that the Charter precludes voting by proxy at General Meetings. No such power is expressly conferred by the Charter, and in the absence of any express powers conferring such a right, no such right exists at common law.

4th. The answer to the 3rd question renders an answer to this question unnecessary.

5th. As the General Body have, in my opinion, no power to interfere with or control the President and Council in their management of the affairs of the Society, I am of opinion that the 13th, 22nd, and 27th Bye-laws, which affect to give the General Body such a power, are beyond the powers of the President and Council, and contrary to the principles of the Charter, and cannot be confirmed by resolutions of the General Body.

6th. I do not see any legal objections to any of the other Bye-laws or Resolutions; but generally they are in a somewhat confused and scattered shape and order, and it would be advisable to have them carefully revised and consolidated, and put into a more regular and consistent form and order.

T. K. KINGDON.

TEMPLE, *February 26th*, 1875.

The Quarterly Reports of the Chemical Committee have recently contained satisfactory evidence that the quality of the manures and feeding-stuffs now supplied to Members of the Society is much better, on the whole, than was formerly the case. Articles which Dr. Voelcker has found on analysis to be of inferior quality, have been frequently ascertained to have been sold, not as "pure," or by the exact name which the purchaser mentioned in his first communication to the Consulting Chemist. In such cases the purchaser has no redress, and he should therefore be careful to ascertain that his linseed-cake is invoiced to him as "pure," that "Bone-dust" is not called "Bone Manure," and so on with other substances.

In consequence of the discontinuance of the Government returns of the number of animals affected with Foot-and-Mouth disease, Pleuro-pneumonia, and other contagious diseases, no record exists of the increase or diminution of such diseases throughout the country, or of the effect of the Orders in Council relating thereto. The Council, therefore, communicated with the Chairmen of Quarter Sessions in each county, with the view of obtaining the reports of the inspectors under the Contagious Diseases (Animals) Act, and any other information in connection therewith that they may be able to supply; but up to the present time they had received reports from only 14 counties.

The Shorthorn Society of Great Britain and Ireland having applied for rooms in the Society's House, the Council have resolved to let the second floor to that Society.

The examination of candidates for the Society's prizes and certificates, including the Life-Membership of the Society, took place as usual at the Society's rooms, from April 13th to 17th inclusive. Six candidates having entered their names in accordance with the regulations, duly presented themselves for examination. Two of these, Messrs. Cathcart and Wilson, of the Royal Agricultural College, Cirencester, obtained First-Class Certificates and the Life Membership of the Society; the former also gained the First Prize of 25*l.*, and the latter the Second Prize of 15*l.* All the other candidates failed to satisfy the Examiners in Chemistry and in one other necessary subject.

By order of the Council,

H. M. JENKINS,

Secretary.

ROYAL AGRICULTURAL

Dr. HALF-YEARLY CASH ACCOUNT

	£ s. d.	£ s. d.	£ s. d.
To Balance in hand, 1st January, 1875:—			
Bankers		514 0 9	
Secretary		22 0 0	
			536 0 9
To Income:—			
Dividends on Stock		314 0 11	
Subscriptions:—			
Governors' Life-Compositions	280 0 0		
Governors' Annual	325 0 0		
Members' Life-Compositions	1,210 0 0		
Members' Annual	3,146 17 0		
		4,961 17 0	
Journal: Sale of Pamphlets		0 4 0	
Potato Disease Investigations: Potatoes sold		19 8 0	
Hull Meeting		2 10 0	
Bedford Meeting		53 14 0	
Total Income		5,351 13 11	
To Taunton Meeting		4,255 13 10	
			9,607 7 9
			£10,143 8 6

BALANCE-SHEET,

LIABILITIES.	£ s. d.	£ s. d.	£ s. d.
To Capital:—			
Surplus, 31st December, 1874		24,727 7 0	
Surplus of Income over Expenditure during the Half-year, viz.:—			
Income	5,351 13 11		
Expenditure	3,223 15 6		
		2,127 18 5	
			26,855 5 5
Less half-year's interest and depreciation on Country Meeting Plant		.. .. ..	194 2 3
			£26,661 3 2

QUILTER, BALL, & CO., *Accountants.*

SOCIETY OF ENGLAND.

FROM 1ST JANUARY TO 30TH JUNE, 1875. Cr.

	£ s. d.	£ s. d.	£ s. d.
By Expenditure:—			
Establishment:—			
Salaries, Wages, &c.	532 10 0		
House:—Rent, Taxes, Repairs, &c.	243 0 6		
Office:—Printing, Postage, &c.	220 10 5		
		996 0 11	
Journal:—			
Printing and Stitching	520 15 11		
Postage and Delivery	187 0 0		
Literary Contributions	150 0 0		
Woodcuts	31 5 6		
Printing Index	189 2 11		
Compiling ditto	35 0 0		
Wrappers for three deliveries	33 10 0		
		1,146 14 4	
Chemical:—			
Consulting Chemist's Salary	150 0 0		
Grant for Investigations	200 0 0		
		350 0 0	
Veterinary:—			
Grant to Royal Veterinary College, to Christmas, 1874		200 0 0	
Botanical:—			
Consulting Botanist's Salary		50 0 0	
Education:—			
Prizes	40 0 0		
Fees to Examiners	52 10 0		
Advertising and Printing	26 2 0		
		118 12 0	
Subscriptions paid in error returned		4 0 0	
Potato Disease Investigations		195 2 0	
Sundries:—			
Law Costs	54 1 6		
Expenses of Inspection Committee	12 2 9		
		66 4 3	
Bedford Meeting		97 2 0	
Total Expenditure		.. .. ..	3,223 15 6
By Country Meeting Plant		150 0 0	
By Taunton Meeting		2,913 13 11	
			3,063 13 11
By Balance in hand, 30th June:—			
Bankers	2,346 5 7		
Secretary	9 13 6		
		2,355 19 1	
At Deposit, London and Westminster Bank		1,500 0 0	
			3,855 19 1
			£10,143 8 6

30TH JUNE, 1875.

ASSETS.	£ s. d.	£ s. d.
By Cash in hand	2,355 19 1	
By Deposit Account	1,500 0 0	
By New 3 per Cent. Stock 21,112*l.* 7*s.* 8*d.* cost*	20,179 2 1	
By Books and Furniture in Society's House	1,451 17 6	
By Country Meeting Plant	2,394 0 8	
		27,880 19 4
Less at credit of Taunton Meeting	.. .. ..	1,219 16 2
		£26,661 3 2

* *Value at* 93¾ = £19,791 17*s.* 2*d.*

Mem.—The above Assets are exclusive of the amount recoverable in respect of arrears of Subscription to 30th June, 1875, which at that date amounted to 1773*l.*

Examined, audited, and found correct, this 16th day of August, 1875.

FRANCIS SHERBORN,
A. H. JOHNSON,
HENRY CANTRELL. } *Auditors on behalf of the Society.*

SHOW AT TAUNTON,

JULY, 1875.

STEWARDS OF THE YARD.

Stock.

M. White Ridley, M.P.,
William H. Wakefield,
Hon. W. Egerton, M.P.
Joseph Shuttleworth,

Implements.

Charles Whitehead,
Jabez Turner,
J. Bowen Jones,
John Hemsley.

Forage.

James S. Bult.

Steward of General Arrangements.

Jacob Wilson.

JUDGES OF STOCK.

HORSES, &c.

M. Biddell,
T. Plowright,
B. Spraggon,
T. H. D. Bayly,
R. G. F. Howard,
A. L. Maynard.

CATTLE.

Shorthorns.

T. Gow,
H. Chandos Pole-Gell,
J. Wood.

Herefords.

Richard Bach,
T. Rogers,
William Taylor.

Devons and Sussex.

H. W. Keary,
J. Overman,
J. Quartly.

Jerseys and Guernseys.

Walter Gilbey,
C. P. Le Cornu.

SHEEP.

Leicesters.

Charles Clarke,
Samuel Field,
Thomas Stamper.

Cotswolds and Lincolns.

J. B. Aylmer,
Henry Beevor,
W. T. Garne, Jun.

Southdowns, Hampshires, and Oxford Downs.

Henry P. Hart,
Henry Overman,
J. E. Rawlence.

Shropshires.

T. Horley, Jun.,
C. R. Keeling,
C. Randell.

Somerset and Dorset Horned, Dartmoors, Exmoors, and Devon Long Wools.

John Carpenter,
H. Mayo,
J. W. Paull.

PIGS.

R. Carver,
W. Cattle,
L. S. Chrisp.

Judges of Butter and Cheese.

W. Clark, | J. Watson.

Inspectors of Shearing, and Judges of Wool.

W. Jobson, | W. Shittler, | J. B. Workman.

Veterinary Inspectors.

Professor Brown, | R. L. Hunt.

JUDGES OF IMPLEMENTS.

Classes I. and II.—Mowing Machines.

Major Grantham, | John Hicken, | J. W. Kimber.

Classes III., IV., and V.—Haymaking Machines, Horse Rakes.

W. Cranfield, | J. D. Ogilvie, | John Thompson.

Miscellaneous Articles, and Special Prizes for Gnard to the Drum of a Threshing Machine, and also combined Guard and Feeder.

Thos. Chambers, | John Lake, | W. Sanday.

Reporter.—John Hemsley.

Farm Judges.

Edward Little, | T. P. Outhwaite, | J. Bowen Jones.

AWARD OF PRIZES.

NOTE.—The Judges were instructed, in addition to awarding the Prizes, to designate as the *Reserve Number* one animal in each Class, next in order of merit, if it possessed sufficient for a Prize; in case an animal to which a Prize was awarded should subsequently become disqualified.

Prizes given by the Taunton Local Committee are marked thus (*).

HORSES.

Agricultural Stallions—Two Years-old.

STEPHEN DAVIS, Woolashill, Pershore: FIRST PRIZE, 20*l.*, for "General," roan, bred by himself; sire, "Captain;" dam, "Pleasant," by "Rowland."

THOMAS STATTER, Stand Hall, Whitefield, Manchester: SECOND PRIZE, 10*l.*, for "Uncle Tom," bay, bred by himself; sire, "Honest Tom;" dam, "Jet."

JAMES FIRTH CROWTHER, Knowl Grove, Mirfield, Yorkshire: THIRD PRIZE, 5*l.*, for "Compact Tom," bay, bred by Mr. W. Taylor, Singleton, Poulton le Fylde, Lancashire; sire, "Honest Tom;" dam by "Napoleon."

STEPHEN DAVIS, Woolashill: the *Reserve Number*, to "Drayman," roan, bred by himself; sire, "Captain;" dam, "Darby," by "Duke of Wellington."

Agricultural Stallions foaled before the 1st of January, 1873.

CHARLES ALBERT TANNER, Yatesbury, Calne, Wilts: FIRST PRIZE, 20*l.*, for "Samson," bay, 4 years-old; bred by Mr. Neville Cuss, West Field Farm, Latton, Cirencester.

THOMAS STATTER, Stand Hall, Whitefield, Manchester: SECOND PRIZE, 10*l.*, for "Young Champion," chestnut, 8 years-old; bred by Mr. T. Stokes, Caldecot, Rockingham; sire, "Champion."

NATHANIEL COOKE, Chevithorne, Barton, Tiverton, Devon: THIRD PRIZE, 5*l.*, for "Samson," bright bay, 9 years-old; bred by Mr. Nix, Somersham, St. Ives, Hunts; sire, "Old Samson."

JAMES FIRTH CROWTHER, Knowl Grove, Mirfield, Yorkshire: the *Reserve Number*, to "Young Honest Tom," bay, 6 years-old: bred by Mr. Jonas Few, Wallingham, St. Ives, Hunts; sire, "Honest Tom;" dam by "Thumper."

Clydesdale Stallions—Two Years-old.

WILLIAM STANFORD, Charlton Court, Steyning, Sussex: FIRST PRIZE, 20*l.*, for his bay; bred by himself; sire, "The Duke;" dam, "Venture."

WILLIAM WHITLOW, The Hotel, Preston Brook, Cheshire: SECOND PRIZE, 10*l.*,

for "Clyde," red roan; bred by Mr. T. Percival, Moss Side, Norton, Warrington; sire, "Lord Lorns;" dam, "Molly."

THOMAS PALMER AND SONS, Borough Kelly, Tavistock, Devon: the *Reserve Number*, to their bay; bred by themselves; sire, "Prince of Wales;" dam, "Jessie."

Clydesdale Stallions foaled before the 1st of January, 1873.

WILLIAM S. GORE LANGTON, Newton Park, Bristol: FIRST PRIZE, 20*l.*, for "Never mind him," brown, 5 years-old; bred by Mr. D. Riddell, Kilborn, Duntocher, Glasgow; sire, "Prince of Wales."

EDWARD and ALFRED STANFORD, Eatons, Ashurst, Steyning, Sussex: SECOND PRIZE, 10*l.*, for "The Duke," brown; bred by the Duke of Hamilton, Hamilton, N.B.; sire, "Sir Walter Scott;" dam, "Bell," by "Lothian Tom."

EDWARD PEASE, The Crandalls, Bewdley, Worcestershire: THIRD PRIZE, 5*l.*, for "Emperor," bay, 5 years-old; bred by Mr. S. Clark, Campbeltown, N.B.; sire, "Largs Jock;" dam, "Lily," by "Young Clyde."

LIEUT.-COLONEL R. LOYD-LINDSAY, V.C., M.P., Lockinge Park, Wantage, Berks: the *Reserve Number*, to "Prince Albert," bay, 7 years-old; bred by Mrs. Snodgrass, Clochkiel, Campbeltown, Argyleshire; sire, "Largs Jock;" dam by "Old Scotchman."

Suffolk Stallions—Two Years-old.

LIEUT-COLONEL FULLER MAITLAND WILSON, M.P., Stowlangtoft Hall, Bury St. Edmund's, Suffolk: FIRST PRIZE, 20*l.*, for "Prince Imperial," chestnut; bred by himself; sire, "Heir Apparent;" dam, "Bury Empress" by "Harwich Emperor."

LIEUT.-COLONEL FULLER MAITLAND WILSON, M.P., Stowlangtoft Hall: the *Reserve Number*, to "Viceroy," chestnut; bred by Mr. Cant, Mile End, Colchester; sire, "Monarch;" dam, "Violet," by "Duke."

Suffolk Stallions foaled before the 1st of January, 1873.

WILLIAM BYFORD, The Court, Glemsford, Suffolk: FIRST PRIZE, 20*l.*, for Statesman," chestnut, 4 years-old; bred by Mr. C. Frost, The Hall, Wherstead, Ipswich; sire, "Talbot;" dam, "Violet," by "Hero."

HORACE WOLTON, The Hall, Newbourne, Woodbridge, Suffolk: SECOND PRIZE, 10*l.*, for "Royalty," chestnut, 4 years-old; bred by himself; sire, "Magnum Bonum;" dam, "Duchess," by "Warrior."

WILLIAM BYFORD, The Court, Glemsford, Suffolk: the *Reserve Number*, to "Active," chestnut, 3 years-old; bred by Mr. C. Button, Uphall, Garboldisham, Suffolk; sire, "Duke;" dam, "Moggie," by "Sovereign."

Thoroughbred Stallions suitable for getting Hunters.

THOMAS GEE, Dewhurst Lodge, Wadhurst, Hawkhurst, Kent: FIRST PRIZE, 50*l.*, for "Citadel," chestnut, 16 years-old; bred by the Earl of Derby, Knowsley; sire, "Stockwell;" dam, "Sortie," by "Melbourne."

HENRY WILLIAM FREEMAN, 24, Circus, Bath: SECOND PRIZE, 20*l.*, for "Claudius," bright bay, 8 years-old; bred by Mr. C. Snewing, Holywell Stud Farm, Rugby; sire, "Caractacus;" dam, "Lady Peel," by "Orlando."

LIEUT.-COLONEL J. SIMPSON BALLARD, the Royal Arsenal, Swansea, Glamorganshire: THIRD PRIZE, 10*l.*, for "Weather Star," brown, 11 years-old; bred by Mr. J. Osborne, Ashgill, Middleham, Yorkshire; sire, "Weatherbit;" dam, "Fairy Knowe," by "Touchstone."

THOMAS KINSMAN BICKELL, St. John's Stud Farm, Lamerton, Tavistock: the *Reserve Number* to "Eastley," chestnut, 10 years-old; bred by Mr. J. H. Goater, Newmarket; sire, "Trumpeter;" dam, "Maud," by "Loup Garou."

Stallions suitable for getting Hackneys.

BENJAMIN BALDERSTON, Mount Pleasant, Boston, Lincolnshire: FIRST PRIZE, 20*l.*, for "Norfolk Hero," dark brown, 9 years-old; bred by Mr. B. B. Mason, Wereham; sire, "Perfection."

WILLIAM BROAD, Angel Hotel, Carmarthen: SECOND PRIZE, 10*l.*, for "Phenomenon," bay, 4 years-old; breeder unknown; sire, "Royal Oak;" dam, "Polly," by "Blacklock."

THOMAS STATTER, of Stand Hall, Whitefield, Manchester: THIRD PRIZE, 5*l.*, for "Perseverance," black, 3 years-old; bred by Mr. Dunham, Wymondham; sire, "Confidence."

CLEMENT CHAMPNEY, Theale, Wells, Somerset: the *Reserve Number*, to "The Flyer," brown bay, 3 years-old; bred by Mr. J. Burrow, Theale.

Pony Stallions.

CHRISTOPHER W. WILSON, High Park, Kendal, Westmoreland: FIRST PRIZE, 20*l.*, for "Sir George," brown, 8 years-old; bred by Mr. W. Walker, Shadwell, Yorkshire; sire, "Sportsman."

JAMES FIRTH CROWTHER, Knowl Grove, Mirfield, Yorkshire: SECOND PRIZE, 10*l.*, for "Cannon Ball," black, 3 years-old; bred by himself; sire, "Shepherd F. Knapp;" dam, "Cunning."

MAJOR WILLIAM MURRAY, 3, Stanhope Place, London: the *Reserve Number*, to "Pluto," brown, aged; breeder unknown; sire, "Lance;" dam by Sir C. Domville's "Arabian."

Agricultural Mares, in-foal or with foal at foot.

THOMAS STATTER, Stand Hall, Whitefield, Manchester: FIRST PRIZE, 20*l.*, for "Royal Duchess;" bay, 8 years-old, in foal to "King Tom;" bred by Mr. C. Lister, Coleby Lodge, Lincoln; sire, "Champion."

HENRY PURSER, Willington Manor, Bedford: SECOND PRIZE, 10*l.*, to "Honest Lass," bay, 5 years-old, in foal to Mr. Stokes's "Champion;" bred by Mr. J. L. Curtis, Chatteris; sire, Welcher's "Honest Tom;" dam, "Pink."

THE EARL OF ELLESMERE, Worsley Hall, Manchester: THIRD PRIZE, 5*l.*, for "Countess," bay, 7 years-old, in foal to "King Tom;" bred by Mr. W. Friar, Deeping St. Nicholas; sire, "Cloot;" dam by "England's Glory."

FREDERICK STREET, Harrowden House, Bedford: the *Reserve Number*, to "Royal Beauty," roan, 9 years-old, in foal to Mr. Stokes's "Young Champion;" bred by Mr. Granger, Haddenham, Ely; sire, Tebbutt's "Thumper."

Clydesdale Mares, in-foal or with foal at foot.

EDWARD AND ALFRED STANFORD, Eatons, Steyning, Sussex: FIRST PRIZE, 20*l.*, for "The Flower," bay, 5 years-old, in foal to "Champion;" bred by themselves; sire, "The Duke;" dam, "Violet."

THE EARL OF ELLESMERE, Worsley Hall, Manchester: SECOND PRIZE, 10*l.*, for "Mrs. Muir," bay, 9 years-old, and foal by "King Tom; bred by Mr. Muir, Loch Fergus, Kirkcudbright, N.B.; sire, "Champion."

JAMES LAWRENCE, Thornhill, Forres, Morayshire: the *Reserve Number*, to "Bell," bay, 4 years-old, in foal; bred by Mr. A. Buchannan, Garscaden Mains, Glasgow.

Suffolk Mares, in-foal or with foal at foot.

HORACE WOLTON, The Hall, Newbourn, Woodbridge, Suffolk: FIRST PRIZE, 20*l.*, for "Brag," chestnut, 5 years-old, and foal by "Royalty;" bred by himself; sire, "Boby's Royal Prince;" dam, "Deppar."

FRANCIS LEYBORNE POPHAM, Hunstrete House, Chelwood, Bristol: the *Reserve Number*, to "Happy," chestnut, aged, and foal by "Moulton;" breeder unknown.

Agricultural Fillies—Two Years-old.

THE EARL OF ELLESMERE, Worsley Hall, Manchester: FIRST PRIZE, 15*l.*, for his bay; bred by Mr. Doughty, Luton Garnsgate, Lincolnshire; sire, "Young Thumper;" dam by "Thumper."

WILLIAM BARBER, Congerstone, Atherstone, Warwickshire: SECOND PRIZE, 10*l.*, for "Flora," brown; bred by Mrs. Millhouse, Sketchley Hall, Hinckley; sire, "A 1;" dam, "Duchess," by "Black Legs."

HENRY PULLEINE, Baxter Hall, Selby, Yorkshire: THIRD PRIZE, 5*l.*, for "Patch," black, bred by himself; sire, "Farmer's Profit;" dam, "Deppar."

FRANCIS NICHOLAS SMITH, Wingfield Park, Derby: the *Reserve Number*, to "Suffolk," chestnut; bred by Mr. J. Ward, East Mersea, Colchester.

Agricultural Fillies—Three Years-old.

CHARLES BEART, Stow, Downham Market, Norfolk: FIRST PRIZE, 15*l.*, for "Lioness," chestnut; bred by Mr. B. Morris, Thorney, Cambs.

THE EARL OF ELLESMERE, Worsley Hall, Manchester: SECOND PRIZE, 10*l.*, for "Duchess," bay; bred by Mr. W. Baker, Moor Barnes, Atherstone; sire, "Robin Hood;" dam, "Bonnie."

LIEUT.-COL. R. LOYD-LINDSAY, V.C., M.P., Lockinge Park, Wantage, Berks: THIRD PRIZE, 5*l.*, for "Milly," bay (Clydesdale); bred by himself; sire, "Prince Albert;" dam, "Maggie," by "Sir Walter."

STEPHEN DAVIS, Woolashill, Pershore, Worcestershire: the *Reserve Number*, to "Flower," chestnut; bred by himself; sire, "Rowland;" dam, "Diamond."

Mares in-foal or with foal at foot, suitable for breeding Hunters.

JOHN MELBOURNE EVANS, The Elms, Farrington Gurney, Bristol: FIRST PRIZE, 20*l.*, for "The Duchess," light chestnut, 6 years-old, in foal to "Flying Comet;" breeder unknown.

JOHN THOMAS ROBINSON, Leekby Palace, Asenby, Thirsk, Yorkshire: SECOND PRIZE, 10*l.*, for "Go-a-head," bay, 17 years-old, and foal by "Argill;" breeder unknown; sire, "Sir William."

JOSEPH HARRIS FRANKLIN, Hexham, Exeter: THIRD PRIZE, 5*l.*, for "Laura," black, 9 years-old, and foal by "Make Haste;" bred by Mr. J. Blackaller, Loventor, Totness; sire, "Ratan;" dam, "Black Bess."

OCTAVIUS WARRE MALET, Haygrass House, Taunton: the *Reserve Number*, to "Jenny," grey, about 14 years-old, and foal by "Marsh Heron;" breeder unknown.

Mares in-foal or with foal at foot, suitable for breeding Hackneys.

THOMAS HORROCKS MILLER, Singleton, Poulton-le-Fylde, Lancashire: FIRST PRIZE, 20*l.*, for "Mabel Gray," grey, aged, and foal by "Jack;" breeder unknown.

HENRY J. BAILEY, Rosedale, Tenbury, Herefordshire: SECOND PRIZE, 10*l.*, for "Sybil," brown, aged and foal by "Double X;" breeder unknown.

ALBERT EDWARD GOULD, Black Heath, Exminster, Exeter: THIRD PRIZE, 5*l.*, for "Tzynda," black, 9 years-old, and foal by "Earl Derby;" breeder unknown; sire, "Young Koropiec;" dam, "Fatima."

CHARLES HENRY PYATT, Victoria Park Farm, Bath: the *Reserve Number*, to his bay, 9 years-old, and foal by "Claudius;" breeder unknown.

Pony Mares in-foal, or with foal at foot, not exceeding 14 *hands.*

WILLIAM SALTER, Barton, North Tawton, Devon: FIRST PRIZE, 15*l.*, for "Multum in Parvo," chestnut, 7 years-old, and foal by "Odd Trick;" bred by himself; sire, "Astonisher;" dam, "Multum in Parvo."

SIR WROTH ACLAND LETHBRIDGE, Bart., Sandhill Park, Taunton: SECOND PRIZE, 10*l.*, for "The Waif," chestnut, aged, and foal; bred by Mr. Loosmore, Rose Ash, Knowstone, Devon; sire, "Old Varmint."

WILLIAM COATES, Scarborough Farm, Winchcombe: THIRD PRIZE, 5*l.*, for "Kitty," chestnut, 9 years-old, and foal by "Cedric;" bred by himself; dam by "Douglas."

Hunter Fillies—Two Years-old.

EDWARD and ALFRED STANFORD, Eatons, Steyning, Sussex: FIRST PRIZE, 15*l.*, for "Gazelle," chestnut; bred by Mr. Hilton, Park Farm, Horsham; sire, "Hotshot;" dam, "Cautious," by "Bandy."

FRANCIS QUARTLY, Brimley, South Molton, Devon: SECOND PRIZE, 10*l.*, for "Starlight," bay; bred by himself; sire, "Varmint;" dam, "Moonbeam."

Hunter Mares—Three Years-old.

TEASDALE HILTON HUTCHINSON, Manor House, Catterick, Yorkshire: FIRST PRIZE, 15*l.*, for "May Queen," brown; bred by the Rev. W. Wharton, Gilling Rectory, Yorkshire; sire, "Honesty."

JOHN MILDON, New House, Puddington, Crediton, Devon: SECOND PRIZE, 10*l.*, for "Lady Mary," chestnut; bred by himself; sire, "Clapham;" dam, "Jewel," by "Young Foxhunter."

JOHN EVANS, Pengam Farm, Cardiff: the *Reserve Number*, to "Gwendoline," bay; bred by himself; sire, "Harcourt;" dam, "Brunette."

Hunter Mares—Four Years-old.

William Armstrong, Fairfield Villa, Kendal, Westmoreland: First Prize, 25*l.*, for "Sunbeam," chestnut; bred by Mr. Atkinson, Oaks, Windermere;" sire, "Carleton;" dam by "Doctor Sangrado."

Nathaniel Cooke, Chevithorne, Barton, Tiverton, Devon: Second Prize, 15*l.*, for "Marygold 2nd," chestnut; bred by himself; sire, "Clapham;" dam, "Marygold 1st," by "Macheath."

George Wood Homer, Athelhampton Hall, Dorchester: Third Prize, 10*l.*, for "Mischief," chestnut; bred by himself; sire, "Harkaway;" dam, "Queen of the Vale."

John Evans, Pengam Farm, Cardiff: the *Reserve Number*, to "Black Bess," black; bred by himself; sire, "Loyola;" dam, "Brunette."

Hunter Geldings—Four Years-old.

George Bland Battams, Kilworthy, Tavistock: First Prize, 25*l.*, for "Kelly," chestnut; bred by Mr. Palmer, Kelly, Tavistock; sire, "Paul Clifford;" dam by "Bowstring."

Hunters (Mares or Geldings), Five Years-old and upwards, up to not less than 12 stone.

Frederick Barlow, Hasketon, Woodbridge, Suffolk: First Prize, 30*l.*, for "King Charming," brown gelding, 6 years-old; bred by Mr. Mason, Borobridge; sire, "Anderby;" dam by "Theon."

Teasdale Hilton Hutchinson, Manor House, Catterick: Second Prize, 20*l.*, for "Lester," brown gelding, 6 years-old; bred by Mr. Gibbons, Burnfoot, Longtown, Cumberland; sire, "Laughing Stock;" dam by "Rowland."

George Bland Battams, Kilworthy, Tavistock: Third Prize, 10*l.*, for "Brother to Palmerston," dark brown gelding, 5 years-old; bred by Mr. Palmer, Kelly, Tavistock; sire, "Rallywood;" dam by "Bowstring."

John Robert Welch, Redlands, Evercreech, Somerset: the *Reserve Number*, to "Brunette," brown mare, 6 years-old; bred by Exhibitor; sire, "Don John;" dam by "Chief Baron."

Hunters (Mares or Geldings), Five Years-old and upwards, up to not less than 14 stone.

William Armstrong, Fairfield Villa, Kendal, Westmoreland: First Prize, 30*l.*, for "The Banker," bay gelding, 7 years-old; bred by Mr. Wakefield, Sedgwick House, Kendal; sire, "Best Returns;" dam, by "Emperor."

Birt St. Albyn Jenner, Bryn-tirion, Bridgend, Glamorganshire: Second Prize, 20*l.*, for "Snowstorm," chestnut gelding, 5 years-old; bred by Mr. W. V. Huntley, Welsh St. Donatis, Cowbridge; sire, "Clapham."

Henry Cooper, Hazelwell House, Ilminster, Somerset: Third Prize, 10*l.*, for "Crown Prince," chestnut gelding, 5 years-old; bred by Mr. Snell, Park Farm, Donyett, Ilminster.

Nathaniel Cooke, Chevithorne Barton, Tiverton: the *Reserve Number*, to "Miss Fenton," brown mare, 5 years-old; bred by himself; sire, "Master Fenton;" dam, "Marygold 1st," by "Macheath."

Hackneys (Mares or Geldings), up to not less than 12 *stone.*

THOMAS GEORGE GOVETT, Huntspill, Bridgwater: FIRST PRIZE, 15*l.*, for "Highland Mary," chestnut mare, 8 years-old; bred by Mr. J. Board, Cannington, Bridgwater; sire, "Magenta;" dam, "Polly."

E. WENTWORTH FISHER H. ALLEYNE, Hillmore, Taunton: SECOND PRIZE, 10*l.*, for "Ready," bay gelding, 8 years-old; breeder unknown.

RICHARD GERRING, Blenheim Park Farm, Woodstock, Oxon: THIRD PRIZE, 5*l.*, for "Silver Maue," dun gelding, about 5 years-old; breeder unknown.

FRANCIS ALLSTON CHANNING, 3, Brunswick Square, Brighton: the *Reserve Number*, to "Beauty," bay mare, aged; breeder unknown.

Hackneys (Mares or Geldings), up to not less than 14 *stone.*

EDWARD GIBBS, Chitterne, Heytesbury, Wilts: FIRST PRIZE, 15*l.*, for "Albert," bay gelding, 7 years-old; bred by Mr. Burrows, Theale Farm, Wells, Somerset; sire, "Flying Comet;" dam by "Phenomine."

RICHARD GERRING, Blenheim Park, Woodstock, Oxon: SECOND PRIZE, 10*l.*, for "Charley," bay gelding, 6 years-old; breeder unknown.

E. WENTWORTH F. H. ALLEYNE, Hillmore, Taunton: the *Reserve Number*, to "Rough," bay gelding, 8 years-old; breeder unknown.

Ponies (Mares or Geldings), above 13 *hands and not exceeding* 14 *hands.*

GEORGE DAVEY, Plaistow Mills, Barnstaple: FIRST PRIZE, 15*l.*, for "Tally Ho," brown gelding, 4 years-old; bred by Mr. Watts, East Heanton, Ilfracombe, Devon; sire, "Harkaway;" dam, "Vixen."

JOHN DREW, Kenton, Exeter: SECOND PRIZE, 10*l.*, for his bay Exmoor gelding, 5 years-old; breeder unknown; sire, "Monastery."

JOHN THOMAS, Arcade Wine Vaults, Cardiff: THIRD PRIZE, 5*l.*, for "Billy," bay gelding, 6 years-old; bred by Mr. M. Morgan, Neath; sire, "Christmas Carol;" dam, "Jenny," by "Cwmro Bach."

FRANCIS FISHLEIGH, jun., Fitzhead, Taunton: the *Reserve Number*, to "Nimble," light-brown gelding, 8 years-old; bred by Mr. E. Maunder, Easley Mills, North Moulton, Devon; sire, "Bobby."

Ponies (Mares or Geldings), not exceeding 13 *hands.*

CHARLES ARTHUR JACOB, The Riding School, Clifton, Bristol: FIRST PRIZE, 15*l.*, for "The Gem," bay gelding, 7 years-old; breeder unknown.

ROBERT POPLE, New London Hotel, Exeter: SECOND PRIZE, 10*l.*, for "Dandy," bay Exmoor gelding, 7 years-old; breeder unknown.

JAMES LAMPARD, Heytesbury, Bath: THIRD PRIZE, 5*l.*, for "Apology," black-brown Exmoor mare, 6 years-old; breeder unknown.

JAMES ROBERT BRIDLE, 62, Charlotte Street, Landport, Portsmouth: the *Reserve Number*, to "Polly," dark bay Exmoor mare, 7 years-old; breeder unknown.

*Jackasses not under 13 hands, for getting Mules for Agricultural purposes.**

Charles Leslie Sutherland, Coombe, Croydon, Surrey: First Prize, 25*l.*, for "Comte de Poitou," black, 5 years-old; bred in Poitou.

A. Gibbs, Tyntesfield, Bristol: Second Prize, 15*l.*, for "Sancho," grey, 6 years-old; imported from Spain.

*Mules not under 15 hands, for Agricultural purposes.**

Charles Leslie Sutherland, Coombe, Croydon: First Prize, 25*l.*, for "Brunette," brown, 5 years-old; bred in Poitou from a cart mare by a Poitou jackass.

Charles Leslie Sutherland: Second Prize, 15*l.*, for "Beauty," grey, 5 years-old; bred in Poitou from a cart mare, by a Poitou jackass.

CATTLE.

Shorthorns—Bulls above Three Years-old.

Alexander Henry Browne, Doxford, Chathill, Northumberland: First Prize, 20*l.*, for "Duke of Aosta" (28,356), roan, 4 years, 7 months, 3 weeks, 6 days-old; bred by Mr. T. H. Hutchinson, Manor House, Catterick; sire, "K.C.B." (26,492); dam, "Queen of Spain," by "Valasco" (15,443); g. d., "Ciss," by "Young Hopewell" (14,719); gr. g. d., "Ciccly," by "Bellemont" (11,164).

William Linton, Sheriff Hutton, York: Second Prize, 10*l.*, for "Sir Arthur Ingram," roan, 3 years, 5 months, 6 days-old; bred by himself; sire, "Serjeant-Major" (29,957); dam, "Fragrance," by "Mountain Chief" (20,383); g. d., "Miss Topsy," by "Blood Royal" (17,423); gr. g. d., "Yorkshire Lass," by "Magnus Troil" (14,880).

William and Henry Dudding, Panton House, Wragby, Lincolnshire: Third Prize, 5*l.*, for "Robert Stephenson" (32,313); roan, 3 years, 8 months-old; bred by Mr. Torr, Aylesby Manor, Grimsby; sire, "Royal Prince" (27,384); dam, Riby Peeress," by "Breastplate" (19,337); g. d., "Riby Queen," by "Booth Royal" (15,673); gr. g. d., "Riby Rose," by "Vanguard" (10,994).

Benjamin St. John Ackers, Prinknash Park, Painswick, Gloucestershire: the *Reserve Number*, to "Cymbeline" (30,835), white, 3 years, 3 months, 3 weeks, 4 days-old; bred by himself; sire, "County Member" (28,268); dam, "Cymbal," by "Eighth Duke of York" (23,808); g. d., "Clarion," by "Archbishop" (17,313); gr. g. d., "Eurydice," by "The Red Duke" (8694).

Shorthorns—Bulls above Two and not exceeding Three Years-old.

Alexander Henry Browne, Doxford, Chathill, Northumberland: First Prize, 20*l.*, for "Rosario," roan, 2 years, 1 month, 2 weeks, 2 days-old; bred by himself; sire, "Duke of Aosta" (28,356); dam, "Bowhill Rosebud," by "Bowhill" (25,653); g. d., "Red and White Napier Rosebud," by "Lord Napier" (14,832); gr. g. d., "Primrose," by "Sam Glen" (10,780).

* Prizes given by Edward Pease, Esq., Greencroft, West Darlington.

Emily, Lady Pigot, Branches Park, Newmarket: Second Prize, 10*l.*, for "Rapid Rhone," red roan, 2 years, 6 months, 3 weeks-old; bred by herself; sire, "Bythis" (25,700); dam, "Dame Swift," by "Prince of Buckingham" (27,161); g. d., "Dame Quickly," by "Valasco" (15,443); gr. g. d., "Barmaid," by "British Prince" (14,197).

The Earl of Ellesmere, Worsley Hall, Manchester: Third Prize, 5*l.*, for "Baron Irwin," roan, 2 years, 10 months, 1 day-old; bred by Mr. Hare, Easingwold; sire, "Lord Irwin" (29,122); dam, "Belle," by "Stearsby" (22,977); g. d., "Rosebud," by "General Friar" (21,811); gr. g. d., "Yorkshire Lass," by "Yorkshireman."

Essex Harries, Scolton, Haverfordwest, Pembrokeshire: the *Reserve Number*, to "Volunteer 2nd," red, 2 years, 2 months, 2 weeks, 3 days-old; bred by Mr. J. Marychurch, East Dudwell, Haverfordwest; sire, "Volunteer"; dam, "Malvern," by "Harold 2nd" (24,101); g. d., "Mermaid 2nd," by "Calvin" (14,221); gr. g. d., "Mermaid," by "Marmion" (9369).

Shorthorns—Yearling Bulls above One and not exceeding Two Years-old.

Alexander Henry Browne, Doxford, Chathill: First Prize, 20*l.*, for "Pioneer," white, 1 year, 3 months, 3 weeks, 3 days-old; bred by himself; sire, "Duke of Aosta" (28,356); dam, "Prunette," by "Lord Plymouth" (24,455); g. d., "Prunella," by "Knight Errant" (18,154); gr. g. d., "Prude," by "Valasco" (15,443).

John Outhwaite, Bainesse, Catterick, Yorkshire: Second Prize, 10*l.*, for "Duke of Chamburgh," roan, 1 year, 10 months, 2 weeks, 6 days-old; bred by himself; sire, "Royal Windsor" (29,890); dam, "Whitesocks," by "Baron Killerby" (27,949); g. d., "Bertha," by "Welcome Guest" (15,497); gr. g. d., by "Vanguard" (10,994).

William Linton, Sheriff Hutton, York: Third Prize, 5*l.*, for "Royal Irwin," white, 1 year, 7 months, 6 days-old; bred by himself; sire, "Lord Irwin" (29,123); dam, "Gratitude," by "Mountain Chief" (20,383); g. d., "Carnation," by "Earl Windsor" (17,788); gr. g. d., "Yorkshire Lass," by "Magnus Troil" (14,880).

James Slee Bult, Dodhill House, Kingston, Taunton: the *Reserve Number*, to "Gallant Gay" roan, 1 year, 3 months, 2 weeks, 5 days-old; bred by Mr. R. Jefferson, Preston Hows, Whitehaven; sire, "Gay Cavalier" (31,223); dam, "Bona Dea," by "Knight of the Shire" (26,552); g. d., "Bonne Fille 2nd," by "Duke of Cumberland" (21,584); gr. g. d., "Bonne Fille," by "Sir Roger" (16,991).

Shorthorns—Bull Calves above Six and not exceeding Twelve Months-old.

Henry Denis de Vitre, Charlton House, Wantage, Berks: First Prize, 15*l.*, for "Duke of Ock," red and white, 11 months, 1 day-old; bred by himself; sire, "Duke of Kennet" (30,977); dam, "Grand Duke's Butterfly," by "4th Grand Duke" (19,874); g. d., "Royal Butterfly's Duchess," by "Royal Butterfly" (16,862); gr. g. d., "Roan Duchess 2nd," by "Frederick" (11,489).

Oriel Viveash, Strensham, Tewkesbury: Second Prize, 10*l.*, for "Hudibras," white, 10 months, 3 weeks, 5 days-old; bred by himself; sire, "Lord Darlington" (29,095); dam, "Edith," by "Mocassin" (18,406); g. d., "Eva," by "Amiens" (14,095); gr. g. d., "Topsy," by "Rebec" (15,132).

William Hosken and Son, Loggan's Mill, Hayle, Cornwall: Third Prize, 5*l.*, for "3rd Baron Wild Eyes," roan, 10 months, 1 week, 6 days-old; bred by themselves; sire, "2nd Baron Wild Eyes" (30,497); dam, "Countess," by "Prince Frederick" (16,734); g. d., "Jocund," by "Brigadier" (14,193); gr. g. d., "Jilt," by "Usurer" (13,929).

John Percival Haslam, Heaton, Bolton, Lancashire: the *Reserve Number*, to "Mantalini Chief," roan, 9 months, 3 weeks, 3 days-old; bred by himself; sire, "Star Chieftain;" dam, "Rose of Winter," by "Prince Regent" (29,677); g. d., "Rose of Summer," by "Prince Hopewell" (13,005); gr. g. d., "Rose of Autumn," by "Sir Henry" (10,824).

Shorthorns—Cows above Three Years-old.

Teasdale Hilton Hutchinson, Manor House, Catterick, Yorkshire: First Prize, 20*l.*, for "Lady Playful," roan, 3 years, 7 months, 3 weeks, 2 days-old, in-milk; bred by himself; sire, "Merry Monarch" (22,349); dam, "Lady Sophia," by "Brigade-Major" (21,312); g. d., "Lady of the Manor," by "Baron Warlaby" (7813); gr. g. d., "Lady Barton," by "Vesuvius" (5559). Calved May 1, 1875.

William Hosken and Son, Loggan's Mill, Hayle, Cornwall: Second Prize, 10*l.*, for "Alexandria," roan, 5 years, 10 months, 1 week, 4 days-old; in-milk and in-calf; bred by themselves; sire, "Second Earl of Oxford" (23,844); dam, "Maid of Athens," by "Sir Richard" (15,298); g. d., "Miss Bloomer," by "Siddington Duke" (15,263); gr. g. d., "Desdemona," by "Guizot" (9174). Calved November 14, 1874.

Benjamin St. John Ackers, Prinknash Park, Painswick, Stroud, Gloucestershire: Third Prize, 5*l.*, for "Queen of the Georgians," rich roan, 3 years, 5 months, 2 days-old; in-milk; bred by himself; sire, "County Member" (28,268); dam, "Georgie's Queen," by "Brigade Major" (21,312); g. d., "Georgie," by "Prince George" (13,510); gr. g. d., "Hopeful," by "Hopewell" (10,332). Calved December 2, 1874.

James Slee Bult, Dodhill House: the *Reserve Number*, to "Bridecake," roan, 5 years, 6 months, 3 weeks, 6 days-old; in-calf; bred by himself; sire, "Earl of Fife" (23,835); dam, "Bride," by "Conqueror" (21,466); g. d., "Anemone 3rd," by "Upstart" (9760); gr. g. d., "Anemone," by "Allan-a-Dale" (7778).

Shorthorns—Heifers in-milk or in-calf, not exceeding Three Years-old.

The Rev. Robert Bruce Kennard, Marnhull, Blandford, Dorset: First Prize, 20*l.*, for "Queen Mary," roan, 2 years, 11 months, 2 weeks, 5 days-old, in-calf; bred by himself; sire, "Grand Duke of Oxford" (28,763); dam, "Queen Anne," by "Lord Stanley 2nd" (26,745); g. d., "Queen Bertha," by "Maccaroni" (24,498); gr. g. d., "Mildred," by "Duke of Norfolk" (17,735).

Teasdale Hilton Hutchinson, Manor House, Catterick: Second Prize, 10*l.*, for "Lady Alicia," roan, 2 years, 5 months, 3 weeks, 4 days-old, in-calf; bred by himself; sire, "King James" (28,971); dam, "Lady Albertá," by "Lord Albert" (20,143); g. d., "Lady of the Manor," by "Baron Warlaby" (7813); gr. g. d., "Lady Burton," by "Vesuvius" (5559).

Thomas Statter, Stand Hall, Whitefield, Manchester: Third Prize, 5*l.*, for "Robin's Rose," roan, 2 years, 9 months, 2 days-old, in-calf; bred by himself, sire, "Robin" (24,968); dam, "Rosa," by "Thorndale Duke" (25,309);

g. d., "Beatrice," by "Touchstone" (20,987); gr. g. d., "Bessie," by "Don Juan" (15,896).

Lord Sudeley, Toddington, Winchcombe, Gloucestershire: the *Reserve Number*, to "Seraphina Bella 2nd," roan, 2 years, 7 months, 3 days-old, in-calf; bred by himself; sire, "Mandarin" (29,269); dam, "Booth's Seraphina," by "Baron Booth" (21,212); g. d., "Seraphina 13th," by "John O'Gaunt" (16,322); gr. g. d., "Seraphina 7th," by "Duke of Sussex" (12,772).

Shorthorns—Yearling Heifers, above One and not exceeding Two Years-old.

Emily, Lady Pigot, Branches Park, Newmarket: First Prize, 15*l.*, for "Zvzeda," roan, 1 year, 9 months, 1 week, 3 days-old; bred by herself; sire, "King James" (28,971); dam, "Lucky Star," by "Ravenspur" (20,628); g. d., Belle Etoile," by "King Arthur" (13,110); gr. g. d., "Princess Maude," by "Prince Arthur" (13,497).

George Fox, Hare Field, Wilmslow, Cheshire: Second Prize, 10*l.*, for "Winsome 16th," roan, 1 year, 10 months, 3 weeks-old; bred by the Duke of Devonshire, Holker Hall; sire, "Baron Oxford 4th" (25,580); dam, "Bright Eyes 5th," by "Grand Duke 6th" (19,876); g. d., "Bonny," by "Oxford Duke" (15,036); gr. g. d., "Beauty," by "Crusade" (7938).

The Rev. Robert Bruce Kennard, Marnhull, Blandford, Dorset: Third Prize, 5*l.*, for "Olga," white, 1 year, 11 months, 1 week-old; bred by himself; sire, "Grand Duke of Oxford" (28,763); dam, "Juliet," by "Wonder" (21,126); g. d., "Ethlinda," by "Marmaduke" (14,897); gr. g. d., "Electra," by "Lovemore" (10,476).

Alfred Thomas Matthews, Church Hanborough, Eynsham, Oxon: the *Reserve Number*, to "Nightfall," white, 1 year, 7 months, 3 weeks, 5 days-old; in-calf; bred by himself; sire, "Royal Cambridge 2nd" (25,010); dam, "Nightwatch," by "Cynric" (19,542); g. d., "Nightshade," by "Royal Oak" (16,870); gr. g. d., Nightlight," by "Havelock" (14,676).

Shorthorns—Heifer Calves, above Six and under Twelve Months-old.

William Nicholson, Basing Park, Alton, Hants: First Prize, 15*l.*, for "Laurel 6th," roan, 10 months, 3 weeks, 5 days-old; bred by himself; sire, "Roman" (32,327); dam, "Laurel," by "Don Juan" (15,896); g. d., "Lilac," by "Marshal St. Arnaud" (14,913); gr. g. d., "Lucretia," by "Fanatic" (12,897).

David McIntosh, Havering Park, Romford, Essex: Second Prize, 10*l.*, for "Charmer 24th," red, 9 months, 1 week, 2 days-old; bred by himself; sire, "Duke of Hainault"; dam, "Charmer 18th," by "3rd Duke of Geneva" (23,753); g. d., "Science," by "Chanter" (19,423); gr. g. d., "Sweetheart 2nd," by "Earl of Dublin" (10,178).

Emily, Lady Pigot, Branches Park, Newmarket: Third Prize, 5*l.*, for "Imperious Queen," light roan, 10 months, 3 weeks, 3 days-old; bred by herself; sire, "Victor Rex" (30,227); dam, "Imperial Rose 2nd," by "Prince of the Empire" (20,578); g. d., "Imperial Rose," by "Prince Imperial" (15,095); gr. g. d., "Red Rose," by "Vanguard" (10,994).

Colonel Charles Towneley, Towneley, Burnley, Lancashire: the *Reserve Number*, to "Wild Flower," roan, 10 months, 5 days-old; bred by Mr. Parker, Fern Hill, Burnley; sire, "Baron Balderson" (30,422); dam,

"Wild Briar," by "Royal Scotforth" (25,042); g. d., "Briar Bud," by "Napoleon" (20,395); gr. g. d., "Miss Briar," by "Petteril" (20,488).

Herefords—Bulls above Three Years-old.

SARAH EDWARDS, Wintercott, Leominster, Herefordshire: FIRST PRIZE, 20*l.*, for "Winter De Cote" (4253), 4 years, 10 months, 3 weeks-old; bred by the late Mr. Thomas Edwards, Wintercott, Leominster; sire, "Leominster 3rd" (3211); dam, "Pinky 3rd;" by "Young Grove" (2888).

HENRY J. BAILEY, Rosedale, Tenbury, Herefordshire: SECOND PRIZE, 10*l.*, for "King of the Dale" (3891), 3 years, 6 months, 3 weeks-old; bred by himself; sire, "Prince Charles" (4041); dam, "Queen of the Valley 2nd;" by "Battenhall" (2406).

JOSEPH E. SPENCER, Fonmon Farm, Cowbridge, Glamorganshire: THIRD PRIZE, 5*l.*, for "Von Moltke," 5 years, 4 months, 3 weeks-old; bred by Mr. Evans, Llandowlais, Usk; sire, "Prince Arthur" (2695); dam, "Dames Violet 3rd," by "Monaughty" (2117).

WARREN EVANS, Llandowlais, Usk, Monmouthshire: the *Reserve Number*, to "Von Moltke 2nd," 3 years, 4 months, 1 week, 5 days-old; bred by himself; sire, "Von Moltke" (4234); dam, "Countess 3rd," by "Monaughty" (2117).

Herefords—Bulls above Two and not exceeding Three Years-old.

WILLIAM TAYLOR, Showle Court, Ledbury, Herefordshire: FIRST PRIZE, 20*l.*, for "Tredegar," 2 years, 6 months, 4 weeks-old; bred by himself; sire, "Mercury" (3967); dam, "Beauty," by "Holmer" (2043).

WILLIAM HARRIS, Great Llansoar, Caerleon, Monmouthshire: SECOND PRIZE, 10*l.*, for "Prince Arthur," 2 years, 2 months, 5 days-old; bred by himself; sire, "Prince Arthur 2nd;" dam, "Lady," by "Goldfinder 3rd."

REES KEENE, Pencraig, Caerleon, Monmouthshire: THIRD PRIZE, 5*l.*, for "Sir Boucher," 2 years, 4 months, 2 weeks, 1 day-old; bred by himself; sire, "Monaughty 3rd" (3262); dam, "Daisy," by "Prince Arthur" (2695).

NATHANIEL BENJAFIELD, Shorts Green Farm, Motcomb, Shaftesbury, Dorset: the *Reserve Number*, to "Young Cardinal," 2 years, 4 months, 1 week, 4 days-old; bred by Mr. J. D. Allen, Tisbury, Salisbury; sire, "Cardinal" (3725); dam, "Lovely."

Herefords—Yearling Bulls above One and not exceeding Two Years-old.

WILLIAM TUDGE, Adforton, Leintwardine, Herefordshire: FIRST PRIZE, 20*l.*, for "Lord Wilton," 1 year, 10 months-old; bred by himself; sire, "Sir Roger" (4133); dam, "Lady Claire," by "Marmion" (3242).

WILLIAM CLEMENT DAVY, Horn Park, Beaminster, Dorset: SECOND PRIZE, 10*l.*, for "Lord Compton," 1 year, 10 months, 2 weeks-old; bred by Mr. W. B. Peren, Compton House, South Petherton; sire, "Lord Lincoln" (3220); dam, "Ivington Rose" by "Sir Thomas" (2228).

PHILIP TURNER, The Leen, Pembridge, Herefordshire: THIRD PRIZE, 5*l.*, for "Viceroy," 1 year, 10 months, 6 days-old; bred by himself; sire, "Provost" (4067); dam, "Kathleen," by "Bolingbroke" (1883).

WILLIAM TAYLOR, Showle Court, Ledbury, Herefordshire: the *Reserve Number*, to "The Big Boy," 1 year, 5 months, 3 days-old; bred by himself; sire, "The Wolverhampton Boy" (4198); dam, "Beauty," by "Holmer" (2043).

Herefords—Bull Calves above Six and not exceeding Twelve Months-old.

WILLIAM TAYLOR, Showle Court, Ledbury, Herefordshire: FIRST PRIZE, 10*l.*, for "Taunton," 11 months, 1 week, 6 days-old; bred by himself; sire, "Triumph 2nd" (3553); dam, "Beauty," by "Holmer" (2043).

SARAH EDWARDS, Wintercott, Leominster, Herefordshire: SECOND PRIZE, 5*l.*, for "Sir Edward," 9 months, 3 weeks, 6 days-old; bred by herself; sire, "Winter de Cote" (4253); dam, "Young Meremaid 3rd," by "Leominster 3rd" (3211).

PHILIP TURNER, The Leen, Pembridge, Herefordshire: the *Reserve Number*, to "Constantine," 10 months, 3 weeks, 6 days-old; bred by himself; sire, "Silver Boy" (3419); dam, "Ariel," by "Bachelor" (2941).

Herefords—Cows above Three Years-old.

THOMAS FENN, Stonebrook House, Ludlow: FIRST PRIZE, 20*l.*, for "Lady Stanton," 3 years, 11 months, 3 weeks, 1 day-old, in-calf; bred by himself; sire, "Severus 2nd" (2747); dam, "Miss Stanton," by "Sir Thomas" (2228).

THOMAS THOMAS, St. Hilary, Cowbridge, Glamorganshire: SECOND PRIZE, 10*l.*, for "Rosaline," 4 years, 11 months, 1 week, 3 days-old, in-calf; bred by himself; sire, "Sir John 3rd" (3456); dam, "Fairy," by "Shamrock" (2750).

WILLIAM BURCHELL PEREN, Compton House, South Petherton, Somerset: THIRD PRIZE, 5*l.*, for "Rosalie," 3 years, 10 months-old, in-calf; bred by himself; sire, "Caractacus" (3001); dam, "Ivington Rose," by "Sir Thomas" (2228).

SARAH EDWARDS, Wintercott, Leominster: the *Reserve Number*, to "Myrtle 3rd," 7 years, 1 month, 1 week, 2 days-old, in-calf; bred by the late Mr. T. Edwards, sire, "Tomboy" (3546); dam, "Myrtle 2nd," by "Adforton" (1839).

Herefords—Heifers, in-milk or in-calf, not exceeding Three Years-old.

JAMES W. JAMES, Mappowder Court, Dorset: FIRST PRIZE, 15*l.*, to "Rosebud," 2 years, 8 months, 1 week, 2 days-old, in-calf; bred by himself; sire, "Leopold" (3912); dam, "Ruby," by "Wonder" (3602).

PHILIP TURNER, The Leen, Pembridge, Herefordshire: SECOND PRIZE, 10*l.*, for "Verbena," 2 years, 11 months, 4 weeks, 1 day-old, in-calf; bred by himself; sire, "Provost" (4067); dam, "Luna," by "Franky" (1243).

JOHN HARDING, The Greenhouse, Bridgnorth, Salop: THIRD PRIZE, 5*l.*, for "Lady Annie," 2 years, 2 weeks-old, in-calf; bred by himself; sire, "Severus 2nd" (2747); dam, "Gentle Annie," by "Symmetry" (2799).

WILLIAM BURCHALL PEREN, Compton House, South Petherton, Ilminster, Somerset: the *Reserve Number*, to "Compton Rose," 2 years, 9 months, 6 days-old, in-calf; bred by himself; sire, "Sir William" (4141); dam, "Ivington Rose," by "Sir Thomas" (2228).

Herefords—Yearling Heifers above One and not exceeding Two Years-old.

THOMAS JAMES CARWARDINE, Stockton Bury, Leominster: FIRST PRIZE, 15*l.*, for "Helena," 1 year, 11 months, 3 weeks, 4 days-old; bred by himself; sire, "De Cote" (3060); dam, "Regina," by "Heart of Oak" (2035).

WILLIAM TAYLOR, Showle Court, Ledbury, Herefordshire: SECOND PRIZE, 10*l.*, for "Cherry," 1 year, 11 months, 2 weeks, 2 days-old; bred by himself; sire, "Mercury" (3967); dam, "Hazel," by "Tom Brown" (2828).

HER MAJESTY THE QUEEN, Windsor Castle: THIRD PRIZE, 5*l.*, for "Duchess of Edinburgh," 1 year, 10 months, 2 weeks-old; bred by Her Majesty, Flemish Farm, Windsor; sire, "Prince Leopold;" dam, "Adelaide 2nd," by "Prince Leopold."

WARREN EVANS, Llandowlais, Usk, Monmouthshire: the *Reserve Number*, to "Lady Blanche," 1 year, 4 months, 2 weeks, 4 days-old; bred by himself; sire, "Von Moltke 2nd;" dam, "Fairmaid," by "Prince Alfred" (3342).

Herefords—Heifer Calves above Six and under Twelve Months-old.

SARAH EDWARDS, Wintercott, Leominster, Herefordshire: FIRST PRIZE, 10*l.*, for "Mabel," 11 months, 3 weeks, 3 days-old; bred by herself; sire, "Winter de Cote" (4253); dam, "Myrtle 3rd," by "Tomboy" (3546).

WILLIAM BURCHALL PEREN, Compton House: SECOND PRIZE, 5*l.*, for "Lady Lottie," 11 months, 2 weeks, 5 days-old; bred by himself; sire, "Lord Lincoln" (3220); dam, "Lady Evie," by "Plutarch" (3332).

PHILIP TURNER, The Leen, Pembridge, Herefordshire: the *Reserve Number*, to "Constance," 11 months, 6 days-old; bred by himself; sire, "Silver Boy" (3419); dam, "Grace," by "Bachelor" (2941).

Devons—Bulls above Three Years-old.

WALTER FARTHING, Stowey Court, Bridgwater: FIRST PRIZE, 20*l.*, for "Master Robin," 3 years, 11 months, 4 weeks-old; bred by himself; sire, "Master Arthur;" dam, "Verbena," by son of "Duke of Somerset."

LORD FALMOUTH, Tregothnan, Probus, Cornwall: SECOND PRIZE, 10*l.*, for "Jonquil" (1131), 6 years, 9 months, 3 weeks, 5 days-old; bred by himself; sire, "Sunflower" (937); dam, "Picture 4th" (2224): and the THIRD PRIZE, 5*l.*, for "Kingcraft" (1132); 5 years, 11 months, 2 weeks-old; bred by himself; sire, "Sunflower" (937); dam, "Peach" (2905A).

MARIA LANGDON, Flitton Barton, North Molton, Devon: the *Reserve Number*, to "Duke of Flitton 8th" (1072), 4 years, 2 months, 2 weeks, 2 days-old; bred by the late Mr. J. Davy, of Flitton Barton; sire, "Duke of Flitton 4th" (827); dam, "Temptress 2nd" (3070), by "Duke of Cornwall" (820).

Devons—Bulls above Two and not exceeding Three Years-old.

WALTER FARTHING, Stowey Court, Bridgwater, Somerset: FIRST PRIZE, 20*l.*, for "Master Willie," 2 years, 3 weeks, 5 days-old; bred by himself; sire, "Master Harry;" dam, "Picture," by "Eclipse."

Major R. H. Buller, C.B., Downes, Crediton, Devon: Second Prize, 10*l.*, for his 2 years, 3 months-old; bred by the late Mr. J. Buller, Downes.

Maria Langdon, Flitton Barton, North Molton, Devon: Third Prize, 5*l.*, for "Young Palmerston" (1251), 2 years, 8 months, 1 week, 6 days-old; bred by the late Mr. J. Davy, Flitton Barton; sire, "Duke of Flitton 5th" (1069); dam, "Lovely Queen" (2846), by "Admiral" (771a).

Thomas Hawkes Risden, Washford, Taunton: the *Reserve Number*, to "Ace of Trumps," 2 years, 4 months, 1 week, 2 days-old; bred by himself; sire, "Corrector;" dam, "Queen of Trumps."

Devons—Yearling Bulls above One and not exceeding Two Years-old.

Lord Falmouth, Tregothnan: First Prize, 20*l.*, for his 1 year, 8 months, 2 weeks-old; bred by himself; sire, "Arthur" (997); dam, "Photograph" (3758).

Maria Langdon, Flitton Barton, North Molton, Devon: Second Prize, 10*l.*, for "Duke of Flitton 12th," 1 year, 2 months, 3 weeks, 2 days-old; bred by herself; sire, "Duke of Flitton 10th" (1074); dam, "Temptress 2nd" (3070), by "Duke of Cornwall" (820).

Walter Farthing, Stowey Court, Bridgwater: Third Prize, 5*l.*, for "Jack," 1 year, 4 months, 3 weeks-old; bred by himself; sire, "Master Robin;" dam, "Milkmaid," by "Master Ellic."

John Azariah Smith, Bradford Peverell, Dorchester: the *Reserve Number*, to "Albert Victor," 1 year, 7 months, 5 days-old; bred by himself; sire, "Duke of York;" dam, "Yellow Bat" (3107), by "Trio" (940).

Devons—Bull Calves above Six and not exceeding Twelve Months-old.

William Smith, Whimple House, Devon: First Prize, 10*l.*, for "The Earl," 11 months, 2 weeks, 4 days-old; bred by himself; sire, Duke of Devonshire"; dam, "Susan," by "Trio" (949).

Sir Alexander Acland Hood, Bart., St. Audries, Bridgwater: Second Prize, 5*l.*, for "Robin Hood," 6 months, 2 weeks-old; bred by himself; sire, "Corrector;" dam, "Pink."

Walter Farthing, Stowey Court, Bridgwater: the *Reserve Number*, to his 10 months, 6 days-old; bred by himself; sire, "Master Robin;" dam, "Cherry 3rd," by "Duke of Flitton 2nd."

Devons—Cows above Three Years-old.

Maria Langdon, Flitton Barton, North Molton: First Prize, 20*l.*, for "Lovely Queen" (2846), 9 years, 2 weeks, 2 days-old, in-calf; bred by the late Mr. J. Davy, Flitton Barton; sire, "Admiral" (771a); dam, "Princess 2nd" (2276), by "Palmerston" (476). Calved, September 1874.

Sir Alexander Acland Hood, Bart., St. Audries, Bridgwater: Second Prize, 10*l.*, for "Lovely," 7 years, 5 months, 1 week-old, in-milk and in-calf; bred by himself; sire, "St. Audries;" dam, "Queen," by "St. Audries." Calved, June 1st, 1874.

John Gould, Bampfylde Lodge, Exeter: Third Prize, 5*l.*, for "Perfection," age unknown, in-milk; bred by Mr. W. Shapland, Tyldon, North Molton. Calved, January 30th, 1875.

GEORGE GIBBS, Bishop's Lydeard, Taunton: the *Reserve Number*, to "Cherry," 6 years, 6 months-old, in-milk and in-calf; bred by himself; dam, "Myrtle." Calved, January, 1875.

Devons—Heifers in-milk or in-calf, not exceeding Three Years-old.

WALTER FARTHING, Stowey Court, Bridgwater: FIRST PRIZE, 15*l.*, for "Prettyface," 2 years, 6 months, 1 week, 3 days-old, in-calf; bred by himself; sire, "Lovely's Duke;" dam, "Prettyface," by "Sir George."

TREVOR LEE SENIOR, Broughton House, Aylesbury: SECOND PRIZE, 10*l.*, for "Moss Rose 1st," 2 years, 11 months, 3 weeks-old, in-milk and in-calf; bred by himself; sire, "Stowey;" dam, "Moss Rose," by "Island Prince" (862).

WILLIAM PERRY, Alder, Lewdon, Devon: THIRD PRIZE, 5*l.*, for "Camellia," 2 years, 10 months, 3 days-old, in-calf; bred by himself; sire, "Champson;" dam, "Croquet" (2592), by "Prince" (906).

MAJOR R. H. BULLER, C.B., Downes, Crediton, Devon: the *Reserve Number*, to his 2 years, 3 months, 3 weeks, 1 day-old, in-calf; bred by the late Mr. J. H. Buller, Downes.

Devons—Yearling Heifers, above One and not exceeding Three Years-old.

HER MAJESTY THE QUEEN, Windsor Castle: FIRST PRIZE, 15*l.*, for "Alice," 1 year, 10 months, 4 days-old; bred by Her Majesty, Norfolk Farm, Windsor; sire, "Prince Imperial;" dam, "Oliver 2nd," by "Duke."

MARIA LANGDON, Flitton Barton, North Molton: SECOND PRIZE, 10*l.*, for "Actress 8th" (3149), 1 year, 10 months, 2 weeks, 6 days-old; bred by herself; sire, "Duke of Flitton 8th (1072);" dam, "Actress 5th" (3146), by "Duke of Flitton 4th" (827).

TREVOR LEE SENIOR, Broughton House, Aylesbury: THIRD PRIZE, 5*l.*, for "Moss Rose 2nd," 1 year, 10 months, 1 week-old; bred by himself; sire, "Gaylad;" dam, "Moss Rose," by "Island Prince" (862).

JOHN AZARIAH SMITH, Bradford Peverell, Dorchester: the *Reserve Number*, to "Pet," 1 year, 8 months, 2 weeks, 3 days-old; bred by himself; sire, "Duke of York;" dam, "Pet," by "Exchange."

Devons—Heifer-Calves above Six and under Twelve Months-old.

GEORGE TURNER, Brampford Speke, Exeter: FIRST PRIZE, 10*l.*, for his 11 months, 3 days-old; bred by himself; sire, "Duke of Devon;" dam, "Lady Evlyn," by "Albert Victor."

WALTER FARTHING, Stowey Court, Bridgwater: SECOND PRIZE, 5*l.*, for his 9 months, 2 days-old; bred by himself; sire, "Forester;" dam, "Nellie," by "Duke."

GEORGE GIBBS, Bishop's Lydeard, Taunton: the *Reserve Number*, to his 7 months, 3 weeks-old; bred by himself; dam, "Myrtle."

Jerseys—Bulls above Two Years-old.

GEORGE DIGBY WINGFIELD DIGBY, Sherborne Castle, Dorset: FIRST PRIZE, 15*l.*, for "Islander," red fawn, 2 years, 2 months, 2 weeks-old; bred by Mr. J. Arthur, St. Mary, Jersey; sire, "Dicky;" dam, "Young Rose."

EDMUND BIRCH GIBSON, Elm Grove, Saffron Walden, Essex: SECOND PRIZE, 10*l*., for "Ducal," dark grey, 2 years, 7 months, 1 week, 1 day-old; bred by Mr. Walter Gilbey, Hargrave Park, Essex; sire, "Banboy;" dam, "Duchess," by "Cardinal" (54).

LOUISA MALCOLM, Beechwood, Lyndhurst, Hants: THIRD PRIZE, 5*l*., for "Le Brun," dark grey, 2 years, 3 months, 2 weeks, 2 days-old; bred by Mr. J. Le Brun, St. Ouens, Jersey; sire, "Duke of Normandy;" dam, "Grisette."

LORD VERNON, Sudbury Hall, Derbyshire: the *Reserve Number*, to "Billy," fawn, 4 years, 2 months-old; bred by himself; sire, "Young Islander;" dam, "Cowslip."

Jerseys—Bulls above One and not exceeding Two Years-old.

CECIL BERNARDINO DIXON, Shirley Warren, Southampton: FIRST PRIZE, 15*l*., for "Prince Charlie," grey, 1 year, 4 months, 1 week, 1 day-old; bred by Mr. W. Kerslake, Grouville, Jersey.

GEORGE SIMPSON, Wray Park, Reigate, Surrey: SECOND PRIZE, 10*l*., for "Gipsy King," light grey, 1 year, 3 months, 2 weeks, 3 days-old; bred by himself; "sire, "Silver Prince;" dam, "Gipsy."

Jerseys—Cows above Three Years-old.

CHRISTOPHER J. H. TOWER, Weald Hall, Brentwood, Essex: FIRST PRIZE, 15*l*., for "Victoria," smoky fawn, aged, in-milk and in-calf; bred by Mr. Walter Gilbey.

HENRY SHORLAND WATTS, Hendford, Yeovil, Somersetshire: SECOND PRIZE, 10*l*., for "Brunette," dark brown, 4 years, 1 month, 1 week, 2 days-old, in-milk; bred by Mr. Mottram, Little Heath Farm, Oxshot, Leatherhead; dam, "Gipsy." Calved January 13, 1875.

GEORGE SIMPSON, Wray Park: THIRD PRIZE, 5*l*., for "Pretty Maid," grey fawn, 6 years, 4 months-old, in-milk; bred by Mr. John Picot, St. John's, Jersey. Calved April 20, 1875.

LORD CHESHAM, Latimer, Chesham, Bucks: the *Reserve Number*, to "Dora," dark silver grey, 3 years, 9 months, 6 days-old, in-milk; bred by himself; sire, "Dandy;" dam, "Dairymaid." Calved in June.

Jerseys—Heifers, in-milk or in-calf, not exceeding Three Years-old.

THOMAS HORROCKS MILLER, Singleton Park, Poulton-le-Fylde, Lancashire: FIRST PRIZE, 15*l*., for "St. Josephine," fawn, 2 years, 10 months-old, in-milk and in-calf; breeder unknown.

CHARLES AUGUSTUS BARNES, Solesbride, Rickmansworth: SECOND PRIZE, 10*l*., for "Verbena," grey fawn, 1 year, 5 months-old, in-calf; bred by Mr. E. Majoribanks, Bushey, Herts; sire, "Lothair;" dam, "Young Vision," by "D'Orsay."

GEORGE SIMPSON, Wray Park: THIRD PRIZE, 5*l*., for "May," light grey fawn, 2 years, 3 months, 2 weeks, 5 days-old, in-milk; bred by himself; sire, "Perfection;" dam, "Madcap," by "Young Duke;" and "Belle," grey fawn, 2 years, 9 months, 1 week, 6 days-old, in-milk; bred by Mr. C. Vibert, St. Ouens, Jersey.

Guernseys—Bulls above One Year-old.

Robert N. G. Baker, Heavitree, Exeter: First Prize, 10*l.*, for "Johnnie," red and white, 2 years, 7 months-old; bred by Mr. Brune, Guernsey; sire, "Champiou;" dam, "Polly."

James Le Patourel, La Ramée, St. Peter Port, Guernsey: Second Prize, 5*l.*, for "Excelsior," light fawn, 3 years, 3 months, 2 weeks-old; bred by Mr. J. Robin, sen., Longcamps, St. Sampson's, Guernsey; sire, "Fair Lad;" dam, "Blanche."

Henry Compton, Manor House, Lyndhurst, Hants: the *Reserve Number*, to "Forester," lemon and white, 1 year, 8 months, 2 weeks-old; bred by himself; dam, "Daffodil."

Guernseys—Cows above Three Years-old.

Robert N. G. Baker, Heavitree, Exeter: First Prize, 10*l.*, for "Beauty," fawn and white, 3 years, 5 months-old, in-calf; bred by Mr. Torson, Guernsey; sire, "Billy;" dam, "Dairymaid."

Henry Compton, Manor House, Lyndhurst: Second Prize, 5*l.*, for "Rosette," yellow and white, 7 years, 9 months, 2 weeks-old, in-milk, calved December 30, 1874; bred by General Huyshe, Guernsey; sire, "Johuny."

Thomas D. Eva, Troon, Camborne, Cornwall: the *Reserve Number*, to "Lady Jane," yellow and white, 5 years, 7 months-old, iu-milk and in-calf; breeder unknown; sire, "Duke;" dam, "Duchess."

Guernseys—Heifers, in-milk or in-calf, not exceeding Three Years-old.

Robert N. G. Baker, Heavitree, Exeter: First Prize, 10*l.*, for "Snowdrop," fawn and white, 2 years, 9 months, 2 weeks-old, in-calf; bred by himself; sire, "Highland Bull;" dam, "Primrose."

Thomas D. Eva, Troon, Camborne, Cornwall: Second Prize, 5*l.*, for "Young Lady Jane," red and white, 2 years, 10 months-old, in-calf; bred by Mr. R. Rendle, Catel, Guernsey; sire, "Young Duke;" dam, "Prize Lady Jane."

Henry Compton, Manor House, Lyndhurst: the *Reserve Number*, to "Dewdrop," red and white, 2 years, 6 months, 2 weeks, 6 days-old, in-milk; bred by himself; sire, "Rufus;" dam, "Rosette," by "Johnny."

Sussex—Bulls above Two Years-old.

George Smith, Paddockhurst, Crawley, Sussex: First Prize, 15*l.*, for "Lion," 5 years, 1 month, 2 weeks, 3 days-old; bred by himself; sire, "Bill;" dam, "Lively," by "Summerveer."

Edward and Alfred Stanford, of Eatons, Ashurst, Steyning, Sussex: Second Prize, 10*l.*, for "Dorchester," 3 years, 7 months, 3 weeks-old; bred by themselves; sire, "Volunteer;" dam, "Mary Fern" (1189), by "Westmiuster" (138).

Philip Howard Ellis, Clayton Court, Hurstpierpoint, Sussex: the *Reserve Number*, to "Knight Errant" (206), 4 years, 6 months, 2 days-old; bred by the late Mr. J. Shoosmith, Berwick, Alfriston, Sussex; dam, "Sweetbriar."

Sussex—Bulls above One and not exceeding Two Years-old.

ALFRED AGATE, West Street, Horsham, Sussex: FIRST PRIZE, 15*l.*, for "Alfred 3rd," 1 year, 11 months, 5 days-old; bred by himself; sire, "Alfred 2nd" (177); dam, "Actress 3rd" (1371), by "Alfred" (152).

Sussex—Cows above Three Years-old.

PHILIP HOWARD ELLIS, Clayton Court, Hurstpierpoint: FIRST PRIZE, 15*l.*, for "Honesty," about 7 years-old, in-milk and in-calf; bred by Mr. E. Cane, Berwick Court, Alfriston, Sussex; sire, "The Czar" (121); dam, "Honesty" (443), by "Unicorn" (15). Calved April 8.

Sussex—Heifers in-milk or in-calf, above Two and not exceeding Three Years-old.

ALFRED AGATE, West Street, Horsham: FIRST PRIZE, 15*l.*, for "Actress 4th," 2 years, 9 months, 2 days-old, in-calf; bred by himself; sire, "Grand Duke" (183); dam, "Actress" (1146), by "Westminster" (138).

SHEEP.

Leicesters—Shearling Rams.

TEASDALE HILTON HUTCHINSON, Manor House, Catterick, Yorkshire: FIRST PRIZE, 20*l.*, for his 1 year, 3 months, 3 weeks-old; bred by himself.

GEORGE TURNER, jun., Thorpelands, Northampton: SECOND PRIZE, 10*l.*, for his 1 year, 3 months, 2 weeks-old; bred by himself: THIRD PRIZE, 5*l.*, for his 1 year, 3 months, 2 weeks-old; bred by himself: and the *Reserve Number*, to his 1 year, 3 months, 2 weeks-old; bred by himself.

Leicesters—Rams of any other age.

TEASDALE HILTON HUTCHINSON, Manor House, Catterick: FIRST PRIZE, 20*l.*, for "Prince Charlie," 3 years, 4 months-old; bred by himself; and SECOND PRIZE, 10*l.*, for his 2 years 4 months-old; bred by himself.

GEORGE TURNER, jun., Thorpelands: THIRD PRIZE, 5*l.*, for his 3 years, 3 months, 2 weeks-old; bred by himself; and the *Reserve Number* to his 2 years, 3 months, 2 weeks-old; bred by himself.

Leicesters—Pens of Five Shearling Ewes of the same Flock.

GEORGE TURNER, jun., Thorpelands: FIRST PRIZE, 15*l.*, for his 1 year, 3 months, 2 weeks-old; bred by himself; and SECOND PRIZE, 10*l.*, for his 1 year, 3 months, 2 weeks-old; bred by himself.

JOHN GOULD, Bampfylde Lodge, Exeter: THIRD PRIZE, 5*l.*, for his 1 year, 4 months-old; bred by himself.

GEORGE TURNER, Brampford Speke, Exeter: the *Reserve Number*, to his 1 year, 3 months, 1 week-old; bred by himself.

Cotswolds—Shearling Rams.

THOMAS BROWN, Marham Hall, Downham Market: FIRST PRIZE, 20*l.*, for his 1 year, 4 months, 2 weeks-old; bred by himself.

Russell Swanwick, the Royal Agricultural College Farm, Cirencester: Second Prize, 10*l.*, for his 1 year, 5 months-old; bred by himself.

Mary Godwin, Troy Farm, Somerton, Deddington, Oxon: Third Prize, 5*l.*, for her 1 year, 3 months, 3 weeks-old; bred by herself.

Thomas Brown, Marham Hall: the *Reserve Number*, to his 1 year, 4 months, 2 weeks-old; bred by himself.

Cotswolds—Rams of any other Age.

Russell Swanwick, the Royal Agricultural College Farm: First Prize, 20*l.*, for his 2 years, 5 months-old; bred by himself; and the Second Prize, 10*l.*, for his 3 years, 5 months-old; bred by himself.

Mary Godwin, Troy Farm, Somerton: Third Prize, 5*l.*, for her 2 years, 3 months, 2 weeks-old; bred by herself.

Thomas Brown, Marham Hall, Downham Market: the *Reserve Number*, to his 3 years, 4 months, 2 weeks-old; bred by himself.

Cotswolds—Pens of Five Shearling Ewes of the same Flock.

Russell Swanwick, the Royal Agricultural College Farm: First Prize, 15*l.*, for his 1 year, 5 months-old; bred by himself.

Mary Godwin, Troy Farm: Second Prize, 10*l.*, for her about 1 year, 3 months, 3 weeks-old; bred by herself.

Lincolns—Shearling Rams.

Thomas Cartwright, Dunstan Pillar, Lincoln: First Prize, 20*l.*, for his 1 year, 4 months-old; bred by himself.

Willam and Henry Dudding, Panton House, Wragby: Second Prize, 10*l.*, for their 1 year, 3 months, 2 weeks-old; bred by themselves.

Richard Newcomb Morley, of Leadenham, Grantham: Third Prize, 5*l.*, for his 1 year, 4 months-old; bred by himself; and the *Reserve Number*, to his 1 year, 4 months-old; bred by himself.

Lincolns—Rams of any other Age.

Algernon Hack, Buckminster, Grantham: First Prize, 20*l.*, for his 3 years, 4 months-old; bred by himself.

William Francis Marshall, Branston, Lincoln: Second Prize, 10*l.*, for his 3 years, 3 months, 2 weeks-old; bred by Thomas Cartwright, Dunston Pillar, Lincolnshire.

John Byron, Kirkby Green, Sleaford: Third Prize, 5*l.*, for his 2 years, 3 months, 2 weeks-old; bred by himself.

Lincolns—Pens of Five Shearling Ewes of the same Flock.

John Byron, Kirkby Green, Sleaford, Lincolnshire: First Prize, 15*l.*, for his 1 year, 3 months, 2 weeks-old; bred by himself.

Thomas Gunnell, Milton, Cambridge: Second Prize, 10*l.*, for his 1 year, 4 months, 1 week-old; bred by himself.

Oxfordshire Downs—Shearling Rams.

A. F. Milton Druce, Twelve Acres, Eynsham, Oxon: First Prize, 20*l.*, for his 1 year, 5 months-old; bred by himself: Second Prize, 10*l.*, for his

1 year, 5 months-old; bred by himself: THIRD PRIZE, 5*l.*, for his 1 year, 5 months-old; bred by himself; and the *Reserve Number*, to his 1 year, 5 months-old; bred by himself.

Oxfordshire Downs—Rams of any other age.

A. F. MILTON DRUCE, Twelve Acres, Eynsham: FIRST PRIZE, 20*l.*, for his 4 years, 5 months-old; bred by himself.

JOHN TREADWELL, Upper Winehendon, Aylesbury: SECOND PRIZE, 10*l.*, for "Bedford," about 3 years, 4 months, 2 weeks-old; bred by himself; sire, "Guildford."

A. F. MILTON DRUCE, Twelve Acres, Eynsham: THIRD PRIZE, 5*l.*, for his 2 years, 5 montbs-old; bred by himself.

JOHN GILLETT, Oaklands, Charlbury, Oxfordshire: the *Reserve Number*, to his 3 years, 4 months, 2 weeks-old; bred by himself.

Oxfordshire Downs—Pens of Five Shearling Ewes of the same Flock.

A. F. MILTON DRUCE, Twelve Acres, Eynsham: FIRST PRIZE, 15*l.*, for his 1 year, 5 months-old; bred by himself.

FREDERICK STREET, Harrowden House, Bedford: SECOND PRIZE, 10*l.*, for his 1 year, 4 months, 2 weeks-old; bred by himself.

ALBERT BRASSEY, Haythrop Park, Chipping Norton, Oxon: THIRD PRIZE, 5*l.*, for his 1 year, 4 months, 2 weeks-old; bred by the Duke of Marlborough, Blenheim Park, Woodstoek.

FREDERICK STREET, Harrowden House: the *Reserve Number*, to his 1 year, 4 months, 2 weeks-old; bred by himself.

Southdowns—Shearling Rams.

LORD WALSINGHAM, Merton Hall, Thetford, Norfolk: FIRST PRIZE, 20*l.*, for his 1 year, 4 months-old; bred by himself: SECOND PRIZE, 10*l.* for his 1 year, 4 months-old; bred by himself.

SIR WILLIAM THROCKMORTON, Bart., Buekland, Faringdon: THIRD PRIZE, 5*l.*, for his 1 year, 4 months-old; bred by himself.

THE DUKE OF RICHMOND, K.G., of Goodwood: the *Reserve Number*, to his 1 year, 5 months-old; bred by himself.

Southdowns—Rams of any other Age.

LORD WALSINGHAM, Merton Hall: FIRST PRIZE, 20*l.*, for his 2 years, 4 months-old; bred by himself.

THE DUKE OF RICHMOND, K.G., of Goodwood, Chichester: SECOND PRIZE, 10*l.*, for his 2 years, 5 months-old; bred by himself.

LORD WALSINGHAM, Merton Hall: THIRD PRIZE, 5*l.*, for his 2 years, 4 months-old; bred by himself.

HUGH SIDNEY WALLER, Farmington, Northleach: the *Reserve Number*, to his 2 years, 3 months-old; bred by himself.

Southdowns—Pens of Five Shearling Ewes of the same Flock.

THE DUKE OF RICHMOND, K.G., of Goodwood, Chichester: FIRST PRIZE, 15*l.*, for his 1 year, 5 months-old; bred by himself.

Lord Walsingham, Merton Hall, Thetford: Second Prize, 10*l.*, for his 1 year, 4 months-old; bred by himself.

John and Alfred Heasman, Angmering, Arundel, Sussex: Third Prize, 5*l.*, for their 1 year, 5 months, 2 weeks-old; bred by themselves.

Jeremiah James Colman, M.P., Carrow House, Norwich: the *Reserve Number*, to his 1 year, 4 months, 1 week-old; bred by himself.

Shropshires—Shearling Rams.

Lord Chesham, Latimer, Chesham: First Prize, 20*l.*, for his 1 year, 3 months-old; bred by himself.

William German, Measham Lodge, Atherstone: Second Prize, 10*l.*, for "Cato," 1 year, 4 months, 1 week-old; bred by himself; sire, "Crown Prince;" sire of dam, "Chancellor."

Joseph Pulley, Lower Eaton, Hereford: Third Prize, 5*l.*, for "Young Sultan," 1 year, 4 months-old; bred by himself; sire, "Sultan," sire of dam, "Buckskin."

Lord Chesham, Latimer: the *Reserve Number*, to his 1 year, 3 months-old; bred by himself.

Shropshires—Rams of any other Age.

Joseph Pulley, Lower Eaton, Hereford: First Prize, 20*l.*, for "Hereford," 2 years, 3 months-old; bred by himself; sire, "Dorchester Hero;" sire of dam, "Fat Back."

Lord Chesham, Latimer, Chesham: Second Prize, 10*l.*, for his 2 years, 3 months-old; bred by himself.

Edward Crane, Shrawardine, Shrewsbury: Third Prize, 5*l.*, for his 2 years, 3 months, 1 week-old; bred by himself; sire, "Claudius;" sire of dam, "Shamrock."

William German, Measham Lodge, Atherstone: the *Reserve Number*, to "Candidate," 2 years, 4 months, 3 weeks-old; bred by himself; sire, "Crown Prince;" sire of dam, "Chancellor."

Shropshires—Pens of Five Shearling Ewes of the same Flock.

Lord Chesham, Latimer, Chesham: First Prize, 15*l.*, for his 1 year, 3 months-old; bred by himself.

Sarah Beach, The Hattons, Brewood, Staffordshire: Second Prize, 10*l.*, for her 1 year, 3 months, 2 weeks-old; bred by herself.

Joseph Pulley, Lower Eaton, Hereford: Third Prize, 5*l.*, for his 1 year, 4 months-old; bred by himself; sire, "Sutton;" sire of dam, "Buckskin."

Harriet Smith, New House, Sutton Maddock, Shifnal, Salop: the *Reserve Number*, to her 1 year, 3 months, 1 week-old; bred by herself.

Hampshires and other Short Wools—Shearling Rams.

Alfred Morrison, Fonthill House, Tisbury, Wilts: First Prize, 20*l.*, for his Hampshire Down, 1 year, 4 months, 2 weeks-old; bred by himself.

Jonathan Rigg, Wrotham Hill Park, Sevenoaks, Kent: Second Prize, 10*l.*, for his Hampshire Down, 1 year, 5 months, 2 weeks-old; bred by himself; sire, "Croydon 1st."

ALFRED MORRISON, Fonthill House: THIRD PRIZE, 5*l.*, for his Hampshire Down, 1 year, 4 months, 3 weeks-old; bred by himself.

ROBERT COLES, Middleton Farm, Warminster, Wilts: the *Reserve Number*, to his Hampshire Down, 1 year, 3 months, 2 weeks-old; bred by himself.

Hampshires and other Short Wools—Rams of any other Age.

WILLIAM NEWTON, Dogdean, Salisbury: FIRST PRIZE, 20*l.*, for his Hampshire Down, 2 years, 5 months-old; bred by James Rawlence, Bulbridge, Salisbury.

ROBERT COLES, Middleton Farm, Warminster: SECOND PRIZE, 10*l.*, for his Hampshire Down, 2 years, 4 months, 2 weeks-old; bred by himself.

ALFRED MORRISON, Fonthill House: THIRD PRIZE, 5*l.*, for his Hampshire Down, 2 years, 4 months, 2 weeks-old; bred by himself.

THOMAS CHAPMAN SAUNDERS, Watercombe, Dorchester: the *Reserve Number*, to his Hampshire Down, 2 years, 5 months-old; bred by himself.

Hampshires and other Short Wools—Pens of Five Shearling Ewes of the same flock.

JONATHAN RIGG, Wrotham Hill Park, Sevenoaks: FIRST PRIZE, 15*l.*, for his Hampshire Down, 1 year, 5 months, 1 week-old; bred by himself.

THOMAS CHAPMAN SAUNDERS, Watercombe, Dorchester: SECOND PRIZE, 10*l.*, for his Hampshire Down, 1 year, 5 months-old; bred by himself.

GEORGE WOOD HOMER, Athelhampton Hall, Dorchester: THIRD PRIZE, 5*l.*, for his Dorsetshire Down, 1 year, 5 months-old; bred by himself.

Somerset and Dorset Horns—Shearling Rams.

JAMES CULVERWELL, Clavelshay, North Petherton, Bridgwater: FIRST PRIZE, 10*l.*, for his 1 year, 6 months, 2 weeks-old; bred by himself: SECOND PRIZE, 5*l.*, for his 1 year, 6 months, 2 weeks-old; bred by himself; and the *Reserve Number*, to his 1 year, 6 months, 2 weeks-old; bred by himself.

Somerset and Dorset Horns—Rams of any other age.

JAMES CULVERWELL, Clavelshay, North Petherton: FIRST PRIZE, 10*l.*, for his 2 years, 6 months, 2 weeks-old; bred by himself; and SECOND PRIZE, 5*l.*, for his 2 years, 6 months, 2 weeks-old; bred by himself.

Dartmoors—Shearling Rams.

JAMES DREW, Artiscombe, Tavistock, Devon: FIRST PRIZE, 10*l.*, for his 1 year, 4 months-old; bred by himself: SECOND PRIZE, 5*l.*, for his 1 year, 4 months-old; bred by himself; and the *Reserve Number*, to his 1 year, 4 months-old; bred by himself.

Dartmoors—Rams of any other age.

JAMES DREW, Artiscombe: FIRST PRIZE, 10*l.*, for his 4 years, 4 months-old; bred by Mr. Thomas Weeks, Tavistock.

ROBERT MAY, Grendon, Tavistock: SECOND PRIZE, 5*l.*, for "Wringworthy," 3 years, 4 months-old; bred by Mr. Thomas Willing, Wringworthy, Mary Tavy, Devon.

Dartmoors—Pens of Five Shearling Ewes of the same flock.

JAMES DREW, Artiscombe: FIRST PRIZE, 10*l.*, for his 1 year, 4-months-old; bred by himself.

ROBERT MAY, Grendon, Tavistock: SECOND PRIZE, 5*l.*, for his 1 year, 4 months-old; bred by himself; sire, "Wringworthy."

JAMES DREW, Artiscombe: the *Reserve Number*, to his 1 year, 4 months-old; bred by himself.

Exmoors—Shearling Rams.

EDMUND PASSMORE, Higher Fyldon, North Molton, Devon: FIRST PRIZE, 10*l.*, for his 1 year, 3 months, 2 weeks-old; bred by himself.

MARIA LANGDON, Flitton Barton, North Molton: SECOND PRIZE, 5*l.*, for "Master Flitton," 1 year, 4 months-old; bred by Mr. E. Passmore, Higher Fyldon, North Molton; sire, "Passmore's No. 1;" sire of dam, "Brinsworthy."

Exmoors—Rams of any other age.

EDMUND PASSMORE, Higher Fyldon: FIRST PRIZE, 10*l.*, for his 4 years, 5 months-old; bred by Mr. Robert Westcott, West Park, North Molton.

MARIA LANGDON, Flitton Barton, North Molton: SECOND PRIZE, 5*l.*, for "Champion 2nd," 3 years, 3 months, 3 weeks-old; bred by the late Mr. James Davy, Flitton Barton; sire, "Champion;" sire of dam, "Collard's No. 1."

JOSHUA CLARKE, Hindon, Minehead, Somerset: the *Reserve Number*, to his 6 years, 3 months-old; bred by Mr. James Quartley, Molland Farm, Molland, Devon.

Exmoors—Pens of Five Shearling Ewes of the same flock.

EDMUND PASSMORE, Higher Fyldon, North Molton: FIRST PRIZE, 10*l.*, for his 1 year, 5 months, 2 weeks-old; bred by himself.

*Devon Long Wools—Shearling Rams.**

SIR JOHN H. HEATHCOATE-AMORY, BART., M.P., Knightsbays Court, Tiverton, Devon: FIRST PRIZE, 10*l.*, for his 1 year, 4 months-old; bred by himself.

GEORGE RADMORE, Court Barton, Thorverton, Collumpton: SECOND PRIZE, 5*l.*, for his 1 year, 3 months, 3 weeks-old; bred by himself.

THOMAS BLAKE, Cutsey, Wellington, Somerset: tho *Reserve Number*, to his 1 year, 4 months-old; bred by himself.

*Devon Long Wools—Rams of any other Age.**

RICHARD CORNER, Torweston, Williton, Somerset: FIRST PRIZE, 10*l.*, for his 2 years, 4 months-old; bred by himself.

SIR JOHN H. HEATHCOATE-AMORY, BART., M.P., Knightsbays Court: SECOND PRIZE, 5*l.*, for his 3 years, 4 months-old; bred by Mr. Corner, Torweston, Williton, Somerset.

CALEB GILES THORNE, Wibble Farm, Williton, Taunton: the *Reserve Number* to his 2 years, 3 months, 3 week-olds; bred by himself.

*Devon Long Wools—Pens of Five Shearling Ewes of the same flock.**

SIR JOHN H. HEATHCOATE-AMORY, BART., M.P., Knightshays Court: FIRST PRIZE, 10*l.*, for his 1 year, 4 months-old; bred by himself.

RICHARD CORNER, Torweston, Williton: SECOND PRIZE, 5*l.*, for his 1 year, 4 months-old; bred by himself.

CHARLES NORRIS, Motion, Exeter: the *Reserve Number*, to his 1 year, 5 months-old; bred by himself.

PIGS.

Large White Breed—Boars above Six and not exceeding Twelve Months-old.

RICHARD ELMHIRST DUCKERING, Northorpe, Kirton-Lindsey, Lincolnshire: FIRST PRIZE, 10*l.*, for "13th Cultivator," 11 months, 1 week-old; bred by himself; sire, "12th Cultivator;" dam, "Primrose."

JACOB DOVE, Hambrook House, Bristol: SECOND PRIZE, 5*l.*, for "Squire," 11 months, 2 weeks, 1 day-old; bred by himself; sire, "Monarch;" dam, "Perfection;" sire of dam, "Jack;" and the *Reserve Number*, to his 7 months, 2 weeks, 1 day-old; bred by himself; sire, "Monarch of the West;" sire of dam, "Ranger."

Large White Breed—Boars above Twelve Months-old.

THE EARL OF ELLESMERE, Worsley Hall, Manchester: FIRST PRIZE, 10*l.*, for "Pride of Idle," 3 years, 10 months, 2 weeks, 4 days-old; bred by Mr. J. Bullock, Idle, Leeds; sire, "Bolivar;" sire of dam, "Shadow."

JACOB DOVE, Hambrook House, Bristol: SECOND PRIZE, 5*l.*, for "Fear-nought," 2 years, 5 months-old; breeder unknown; sire, "Duke;" sire of dam, "Jaincey."

JAMES and FREDERICK HOWARD, Britannia Farms, Bedford: the *Reserve Number*, to "Duke," 4 years, 4 months, 3 weeks, 5 days-old; bred by themselves; sire, "Manchester;" dam, "Duchess;" sire of dam, "Long-ville."

Large White Breed—Pens of Three Breeding Sow Pigs of the same litter, above Four and under Eight Months-old.

THE EARL OF ELLESMERE, Worsley Hall: FIRST PRIZE, 10*l.*, for his 7 months, 3 weeks, 4 days-old; bred by himself; sire, "Champion."

JACOB DOVE, Hambrook House, Bristol: SECOND PRIZE, 5*l.*, for "Spot Blanches," 7 months, 2 weeks, 6 days-old; bred by himself; sire, "Monarch;" dam, "Blanche 2nd;" sire of dam, "Prince Charlie."

Large White Breed—Breeding Sows.

THE EARL OF ELLESMERE, Worsley Hall: FIRST PRIZE, 10*l.*, for his 2 years, 3 months-old; bred by himself.

JACOB DOVE, Hambrook House: SECOND PRIZE, 5*l.*, for "Lilly," 2 years, 7 months, 1 week, 4 days-old; bred by himself; sire, "Sailor;" dam, "York;" sire of dam, "Jack."

Richard Elmhirst Duckering, Northorpe, Kirton-Lindsey: the *Reserve Number*, to "Primrose," 2 years, 1 month, 1 week-old; bred by himself; sire, "Victor 1st;" dam, "Countess of Leicester;" sire of dam, "9th Cultivator."

Small White Breed—Boars above Six and not exceeding Twelve Months-old.

Jacob Dove, Hambrook House, Bristol: First Prize, 10*l.*, for "Jolly Boy 3rd," 7 months, 3 weeks, 2 days-old; bred by himself; sire, "Mouse;" dam, "Polly;" Second Prize, 5*l.*, for "Punch 2nd," 11 months, 3 weeks, 3 days-old; bred by himself; sire, "Mouse;" dam, "Beauty;" sire of dam, "Victor 2nd;" and the *Reserve Number*, to "Mouse 2nd," 11 months-old; bred by himself; sire, "Mouse;" dam, "Little Beauty;" sire of dam, "Soldier."

Small White Breed—Boars above Twelve Months-old.

George Mumford Sexton, Wherstead Hall, Ipswich: First Prize, 10*l.*, for "Disturbance," 3 years, 6 months-old; bred by himself; sire, "Peter;" dam, "Commotion," sire of dam, "Suffolk."

The Earl of Ellesmere, Worsley Hall: Second Prize, 5*l.*, for his 2 years, 1 month-old; bred by himself.

Richard Elmhirst Duckering, Northorpe, Kirton-Lindsey: the *Reserve Number*, to "Champion," 1 year, 5 months, 2 weeks-old; bred by Mr. Edward Harrison, Denton, Lancashire.

Small White Breed—Pens of Three Breeding Sow Pigs of the same litter, above Four and under Eight Months-old.

Jacob Dove, Hambrook House, Bristol: First Prize, 10*l.*, for his 7 months, 3 weeks, 5 days-old; bred by himself; sire, "Mouse;" dam, "Queen;" sire of dam, "Sam."

Small White Breed—Breeding Sows.

The Earl of Ellesmere, Worsley Hall: First Prize, 10*l.*, for his 2 years, 1 month-old; bred by himself.

George Mumford Sexton, Wherstead Hall, Ipswich: Second Prize, 5*l.*, for "Pure Small," 1 year, 1 month, 4 days-old, in-pig; bred by himself; sire, "Disturbance;" sire of dam, "Son of Snowball."

The Earl of Ellesmere, Worsley Hall: the *Reserve Number*, to his 2 year-old; bred by Mr. Sedgwick, York.

Small Black Breed—Boars above Six and not exceeding Twelve Months-old.

George Mumford Sexton, Wherstead Hall: First Prize, 10*l.*, for "Galopin," 11 months, 3 weeks, 2 days-old; bred by himself; sire, "Holy Friar;" dam, "Black Diamond Again;" sire of dam, "Butley Sambo."

Richard Elmhirst Duckering, Northorpe, Kirton-Lindsey: Second Prize, 5*l.*, for "Wonder," 11 months-old; bred by himself; sire, "Black Prince;" dam, "Black Girl."

Thomas Rowell Cornish, Wolfsgrove, Bishopteignton, Teignmouth, Devonshire: the *Reserve Number*, to his 11 months, 4 weeks-old; bred by himself; sire, "Agricola."

Small Black Breed—Boars above Twelve Months-old.

Rev. William Hooper, Chilfrome Rectory, Dorchester: First Prize, 10*l.*, for "The Real Sir Roger," 1 year, 2 months, 2 weeks, 1 day-old; bred by Mr. John A. Smith, Bradford Peverell, Dorchester; sire of dam, "The Claimant."

George Mumford Sexton, Wherstead Hall: Second Prize, 5*l.*, for "Holy Friar," 2 years, 2 months, 1 week, 1 day-old; bred by himself; sire, "Adventurer;" dam, "Achievement;" sire of dam, "Stockwell."

William Frederick Collier, Woodtown, Hurrabridge, Devon: the *Reserve Number*, to his 1 year, 3 months, 1 week, 4 days-old; bred by himself.

Small Black Breed—Pens of Three Breeding Sow Pigs of the same litter, above Four and under Eight Months-old.

George Mumford Sexton, Wherstead Hall: First Prize, 10*l.*, for "Just in Time," 7 months, 3 weeks, 6 days-old; bred by himself; sire, "Prince Charlie;" dam, "Sister to Lady Love;" sire of dam, "Gladiateur:" Second Prize, 5*l.*, for "Rare Bright Diamonds," 6 months, 3 weeks, 4 days-old; bred by himself; sire, "Holy Friar;" dam, "Daughter of Black Diamond Again;" sire of dam, "Butley Sambo."

Small Black Breed—Breeding Sows.

George Mumford Sexton, Wherstead Hall, Ipswich: First Prize, 10*l.*, for "Lady Love," 1 year, 3 months, 6 days-old, in-pig; bred by himself; sire, "Gladiateur;" sire of dam, "Adventurer:" Second Prize, 5*l.*, for "Black Diamond 3rd," about 2 years-old; bred by himself; sire, "Blair Athol;" dam, "Black Diamond Again;" sire of dam, "Adventurer;" and the *Reserve Number*, to "Spinaway," 1 year, 7 months, 3 weeks, 1 day-old; bred by himself; sire, "Blair Athol;" dam, "Adventuress;" sire of dam, "Adventurer."

Berkshire Breed—Boars above Six and not exceeding Twelve Months-old.

Jacob Dove, Hambrook House, Bristol: First Prize, 10*l.*, for his 11 months, 5 days-old; breeder unknown; sire, "Smithereen;" dam, "Slavedriver's Niece."

Heber Humfrey, Kingstone Farm, Shrivenham: Second Prize, 5*l.*, for "Pulchritude," 11 months, 4 days-old; bred by himself; sire, "Smithereen;" dam, "Slavedriver's Niece."

Russell Swanwick, Royal Agricultural College Farm, Cirencester: the *Reserve Number*, to his 9 months, 4 weeks, 1 day-old; bred by himself; sire, "H 2 Boar;" dam, "Sally 7th."

Berkshire Breed—Boars above Twelve Months-old.

William Hewer, Sevenhampton, Highworth: First Prize, 10*l.*, for for "First Fruits," 2 years, 5 months, 3 weeks-old; bred by himself; sire, "Wallace;" dam, "Faithful;" sire of dam, "The Squire."

Heber Humfrey, Kingstone Farm, Second Prize, 5*l.*, for "Hillsmere," 2 years, 2 weeks, 3 days-old; bred by himself; sire, "Delamere;" dam, "Hillside Damsel."

Arthur Stewart, Saint Bridge, Gloucester: the *Reserve Number*, to

"The Duke of Saint Bridge," 1 year, 3 months, 5 days-old; bred by himself; sire, "Robinwood;" dam, "Sniper 5th;" sire of dam, "Blacksmith."

Berkshire Breed—Pens of Three Breeding Sow Pigs of the same litter, above Four and under Eight Months-old.

William Hewer, Sevenhampton, Highworth: First Prize, 10*l.*, for his 7 months, 1 week-old; bred by himself; sire, "Union Jack 2nd;" dam, "Harmony;" sire of dam, "Wallace."

Heber Humfrey, Kingstone Farm: Second Prize, 5*l.*, for "Sky Blue," "Skylight," and "Skyrocket," 7 months, 2 weeks, 4 days-old; bred by Mr. A. C. Bailey, of Swindon.

Benjamin St. John Ackers, Prinknash Park, Painswick, Stroud: the *Reserve Number*, to his 7 months, 3 weeks, 6 days-old; bred by himself; sire, "Hesperian Major;" dam, "Favourite;" sire of dam, "Blacksmith 2nd."

Berkshire Breed—Breeding Sows.

Richard Elmhirst Duckering, Northorpe, Kirton-Lindsey: First Prize, 10*l.*, for "Rose," 1 year, 8 months, 4 weeks-old; bred by Lord Rendlesham, Home Farm, Wickham Market; sire, "Major;" dam, "Jessica."

Robert N. G. Baker, Heavitree, Exeter: Second Prize, 5*l.*, for "Lady Jane," 2 years, 9 months, 3 weeks, 6 days-old, in-pig; bred by Mr. A. Stewart, Saint Bridge, Gloucester; sire, "Sampson;" dam, "Sniper 1st;" sire of dam, "Tim Whiffler."

Heber Humfrey, Kingstone Farm: the *Reserve Number*, to "Sidewalk," 2 years, 2 months, 3 weeks-old, in-pig; bred by Mr. Matthew Walker, Chaddesden, Derby; sire, "Kingcraft;" dam, "Gipsy 1st."

Other Breeds—Boars above Six and not exceeding Twelve Months-old.

Jacob Dove, Hambrook House, Bristol: First Prize, 10*l.*, for his middle improved Yorkshire, "Matchless," white, 11 months, 3 weeks-old; breeder unknown; sire, "Pretender;" dam, "Topsy 6th;" sire of dam, "Young Prince."

Other Breeds—Boars above Twelve Months-old.

The Earl of Ellesmere, Worsley Hall: First Prize, 10*l.*, for his white, 2 years-old; bred by himself; and Second Prize, 5*l.*, for his white; age and breeder unknown.

John Moir and Son, Garthdee, Aberdeen: the *Reserve Number*, to "Emperor," white, 2 years, 4 months, 3 weeks, 6 days-old; bred by the Earl of Ellesmere.

Other Breeds—Pens of Three Breeding Sow Pigs of the same Litter, above Four and under Eight Months-old.

The Earl of Ellesmere, Worsley Hall: First Prize, 10*l.*, for his white 6 months, 1 week-old; bred by himself.

Other Breeds—Breeding Sows.

THE EARL OF ELLESMERE, Worsley Hall: FIRST PRIZE, 10*l.*, for his white, 2 years, 1 month-old; bred by himself; and SECOND PRIZE, 5*l.*, for his white, 2 years, 8 months, 2 weeks-old; bred by himself.

JACOB DOVE, Hambrook House, Bristol: the *Reserve Number*, to his middle improved Yorkshire, "Perfection's Daughter," white, in-pig, 1 year, 11 months, 2 weeks-old; bred by himself; sire, "Mouse;" dam, "Perfection;" sire of dam, "Jack."

LONG WOOL.*

Six Fleeces.

WILLIAM and GEORGE BIRD, Volis, Kingston, Taunton: FIRST PRIZE, 5*l.*

RICHARD CORNER, Torweston, Williton, Somerset: SECOND PRIZE, 3*l.*

BUTTER.*

Six Pounds.

SIR J. H. HEATHCOATE-AMORY, Bart., M.P., Knightshays Court, Tiverton, Devonshire: FIRST PRIZE, 5*l.*

EDWIN GEORGE HALLETT, Park Dairy, Tolperdale, Dorchester: SECOND PRIZE, 3*l.*

CHEESE.*

Over 6 inches in thickness, not less than 1 cwt.

STEPHEN MILLARD HARDING, Almondsbury, Bristol: FIRST PRIZE, 5*l.*

JOSEPH PADFIELD, Parsonage Farm, Chisledon, Swindon: SECOND PRIZE, 3*l.*

Under 6 inches in thickness, not less than 56 lbs.

STEPHEN MILLARD HARDING, Almondsbury, Bristol: FIRST PRIZE, 5*l.*

JOHN SMITH, Nupdown Farm, Thornbury, Gloucestershire: SECOND PRIZE, 3*l.*

SOMERSETSHIRE PRIZE FARMS.

CLASS 1.—*Hill Farms.*

GEORGE BABBAGE, Nettlecombe, Taunton: FIRST PRIZE, 50*l.*

CLASS 2.—*Dairy Farms.*

GEORGE GIBBONS, Tunley Farm, Bath: FIRST PRIZE, 50*l.*

ROBERT ALFRED DAY, Ubley Farm, Bristol: SECOND PRIZE, 25*l.*

CLASS 3.—*Farms not qualified to compete in either of the above classes.*

OBED HOSEGOOD, Dillington Farm, Ilminster: FIRST PRIZE, 50*l.*

ALFRED BOWERMAN, Capton Farm, Williton: SECOND PRIZE, 25*l.*

IMPLEMENTS.

One-horse Mowing Machines.

HORNSBY and SONS, Spittlegate, Grantham: FIRST PRIZE, 20*l.*

Two-horse Mowing Machines.

HORNSBY and SONS: FIRST PRIZE, 30*l.*; SECOND PRIZE, 20*l.*; THIRD PRIZE, 10*l.*; and HIGHLY COMMENDED.

SAMUELSON and Co., Banbury: Two HIGHLY COMMENDED.

BURGESS and KEY, Holborn Viaduct: COMMENDED.

HARRISON MACGREGOR and Co., Leigh, Lancashire: COMMENDED.

WALTER A. WOOD, Worship Street, E.C.: COMMENDED.

Haymaking Machines.

ASHBY, JEFFERY, and LUKE, Stamford: FIRST PRIZE, 20*l.*; SECOND PRIZE, 10*l.*

The READING IRONWORKS COMPANY, Reading: THIRD PRIZE, 5*l.*, and COMMENDED.

W. N. NICHOLSON and SON, Newark-on-Trent: COMMENDED.

Self-Acting Horse Rakes.

W. N. NICHOLSON and SON: FIRST PRIZE, 15*l.*

HAUGHTON and THOMPSON, Carlisle: SECOND PRIZE, 10*l.*

Horse Rakes not Self-Acting.

W. N. NICHOLSON and SON: FIRST PRIZE, 15*l.*; SECOND PRIZE, 10*l.*; and HIGHLY COMMENDED.

Guards or Appliances to the Drums of Thrashing Machines.

J. P. FISON, Teversham Works, Cambridge: FIRST PRIZE, 20*l.*

W. TASKER and SONS, Andover: SECOND PRIZE, 10*l.*

Combined Guards and Feeders to the Drums of Thrashing Machines.

CLAYTON and SHUTTLEWORTH, Lincoln: FIRST PRIZE, 20*l.*

MARSHALL, SONS, and Co., Gainsborough: SECOND PRIZE, 10*l.*

MISCELLANEOUS AWARDS

To Agricultural Articles not included in the Ordinary Rotation.

SILVER MEDALS.

BARFORD and PERKINS, Peterborough: for Savage's Improvement of Campain's Anchor.

L. AUGUSTUS ASPINWALL, American Exchange, 449, Strand, London: for his Potato Planter.

AGRICULTURAL EDUCATION.

Examination Papers, 1875.

EXAMINATION IN MECHANICS AND NATURAL PHILOSOPHY.

MAXIMUM NUMBER OF MARKS, 200. PASS NUMBER, 100.

Tuesday, April 13th, from 10 *a.m. till* 1 *p.m.*

1. What is meant by the resolution of a force? Show (by construction or otherwise) how a force can be resolved into two others along assigned lines drawn through a point in its line of action.

Let A and B be two points, to which are fastened the ends of threads AC and BC, the former inclined to the vertical through C at an angle of 30°, the latter at an angle of 60° on the other side of the vertical; it is known that A C cannot be subjected with safety to a tension of more than 30 lbs., while BC is much stronger; what is the greatest weight that can be safely hung from C?

2. What is in general the relation between two forces which are in equilibrium on a weightless lever capable of turning freely round a fixed fulcrum?

If the lever is in a horizontal position, and the forces respectively are of 5 units acting vertically upward, and of 3 units acting vertically downward, show by a diagram how the forces must act relatively to the fulcrum, and ascertain the amount and direction of the pressure on the fulcrum.

3. Two iron rods (of equal uniform section) APB and CPD, 6 ft. and 8 ft. long respectively, lie across one another so that the angle APC is 45°; PB and PD are each 2 ft. long; find the centre of gravity of the two rods.

4. What is meant by the horse-power of a steam-engine?

If a plough worked by an engine of 20 horse-power cuts four furrows 1000 yards long in 6 min., what is the average force exerted by each ploughshare against the soil?

5. What is meant by the accelerative effect of a force?

When the accelerative effect of gravity at a certain place is said to be 32·2, what is meant by this statement, and what units of time and distance does it presuppose?

6. A body (P) moves in a circle whose radius is three times that of a circle in which another body (Q) is moving; the bodies have equal

masses and move with equal uniform velocities in their respective circles; if F is the force acting on P, and f that acting on Q, find the relation between F and f, and state exactly how these forces act.

7. A wooden ball is tied by a thread to the bottom of a vessel; water is poured in till the ball floats but is completely under water; why must the thread be vertical when the ball is at rest?

If the tension of the thread is one-third the weight of the ball, what is the specific gravity of the ball?

8. Explain the action of a common syphon. If the out-flow is to be rapid, why must there be a considerable difference in the lengths of the legs of the instrument?

9. If a pound of water at 40° F. is mixed with a pound of water at 156° F., what is the temperature of the mixture? If a pound of mercury at 40° F. is shaken up with a pound of water at 156° F., would the resulting temperature be the same as in the former case or not?

What general principle is illustrated by these two cases?

What is meant by the specific heat of a substance?

EXAMINATION IN MENSURATION AND SURVEYING.

MAXIMUM NUMBER OF MARKS, 100. PASS NUMBER, 50.

Tuesday, April 13th, from 2 p.m. till 5 p.m.

1. A rectangular piece of ground is a quarter of a mile long and a furlong wide; a border of uniform width is trenched round it so as to leave an unbroken area of 10 acres in the middle; what are the length and breadth of this area?

2. How many gallons of water can be held in a pipe a mile long and 4 in. in internal diameter?

3. How many cubic yards of earth must be dug out in forming a ditch 1000 yds. long, 4 ft. deep, and 6 ft. wide at top, and 3 ft. wide at bottom?

4. A hollow sphere 2 in. thick weighs 218 lbs., when filled with the same material as itself it weighs 343 lbs.; what is its external diameter? and what the specific gravity of the material?

5. If a road is inclined at the rate of 3 ft. vertical to 25 ft. horizontal; determine its slope in degrees, minutes, and seconds.

6. A base AB is measured and found to be 725 ft. long; a distant point P is observed and it is found that the angles PAB and PBA are respectively 57° 18′ and 115° 42′; determine both by calculation and construction, (1) the distances PA and PB; (2) the perpendicular distance of P from the line AB; (3) the point where the perpendicular cuts AB or AB produced; (4) the area of the triangle ABC.

7. A line is marked on the ground by pickets A and B; an accessible point (P) is given at a moderate distance from AB; show how to determine on the ground the point where a perpendicular let fall from P on AB cuts that line.

8. You are provided only with chain and pickets and have to survey a field with five sides, which we will suppose to be straight lines; one of the sides however is cut by a wide pond so that you cannot chain across it; explain by what measurements you will be enabled to lay down a plan of the field.

9. A and B are two points on the boundary of a field 12 chains apart; in going from A to B, when the offsets are taken to the left the chain is outside the field, when to the right it is inside the field. At the end of each chain in succession from A the offsets severally are as follows:—to the right 20, 30, 50, 20, 0; to the left 10, 15, 30, 60, 30, 20, 0. Lay down the boundary and determine the difference between the areas within and without the field.

EXAMINATION IN CHEMISTRY.

MAXIMUM NUMBER OF MARKS, 200. PASS NUMBER, 100.

I. GENERAL CHEMISTRY.

Wednesday, April 14th, from 10 a.m. till 1 p.m.

1. State the composition of atmospheric air. Explain how the presence of carbon di-oxide in the atmosphere may be detected, and how the proportion in which it is present may be determined.

2. What are the relative densities of oxygen, nitrogen, water-vapour, and carbon di-oxide at the same temperature and pressure? Explain, by reference to general laws, why the temperature and pressure must be taken into account: also why in a mixture of gases the most dense does not sink to the bottom.

3. Name substances frequently met with in nature and containing S and P respectively. State how these elements are combined in each case. Describe the chief characters of S and P.

4. Describe the preparation of chlorine, sulphuretted hydrogen, and caustic soda, respectively, explaining the chemistry of the processes. Give the chemical reaction of each one of these substances with each of the other two.

5. Calculate the quantity of bone-earth which 1 lb. (7000 grs.) of oil of vitriol will convert into soluble superphosphate. (O : S : P : Ca = 16 : 32 : 31 : 40.)

6. Give the chemical constitution of alumina, silica, and rusts of iron and copper. Under what circumstances are the first two of these substances soluble in water? Explain how they can be detected in solution.

7. Give the chemical composition of urea, explain its relation to ammonia, and how it may be made to yield the latter substance.

8. Explain the chemical nature of wood, and the products to which it gives rise when heated (1) with, (2) without, access of air.

9. What are the conditions requisite for the alcoholic fermentation of sugar? Explain the chemical changes which occur during such fermentation.

II. Agricultural Chemistry.

Wednesday, April 14th, from 2 p.m. till 5 p.m.

1. From what sources and in what forms do plants take up nitrogen?

2. Give a list of nitrogenous manures, state their composition, comparative efficacy, and commercial value.

3. In what combinations occur the following elements in soils, and in what forms are they assimilated by plants:—P. S. K. Si. Ca. Mg.?

4. Point out the difference in the composition and feeding value of sugar-beets and common mangolds. Is it more profitable to the British farmer to sell sugar-beets at £1 a ton, or to consume them on the farm? Give reasons.

5. What are the properties and composition of pure and inferior linseed-cakes? State adulterations in linseed-cakes and the means of detecting them.

6. What is the composition and relative feeding and manuring value of decorticated and undecorticated cotton-cake? Mention some precautions which should be taken in feeding cattle upon cotton-cake.

7. Write a short paper on improving permanent pasture by means of suitable manures.

8. Explain the action of the following substances as disinfectants:—Lime, chloride of lime, charcoal, chloride of zinc, sulphurous acid, carbolic acid, permanganate of Potash.

9. What are the chemical characters of drainage waters from infertile soils and from highly manured land?

EXAMINATION IN AGRICULTURE.

Maximum Number of Marks, 200. Pass Number, 100.

Thursday, April 15th, from 10 a.m. till 1 p.m.

1. State the chief conditions to be set forth in an agreement for a yearly tenancy of 300 acres of friable loam, one-third pasture, with entry at Michaelmas.

2. On a farm of 300 acres, one-third pasture, and carrying a

breeding stock, roughly sketch the ground plan of the necessary buildings.

3. State the average cost per acre of steam-ploughing clay land nine inches deep, and cultivating six inches deep; hand-hoeing wheat twice over; thinning and twice hand-hoeing mangold; taking up, cleaning, and heaping in the field a 15-ton crop of swedes; reaping by hand a 5-quarter crop of wheat; tying up and shoking a similar crop behind the machine.

4. Describe the several points in order of their importance by which you estimate the efficiency of a portable steam thrashing-machine.

5. Describe briefly the prominent distinctive characters of the Chillingham Park, Short-horn, Devon, Angus, and Ayrshiro cattle.

6. Specify the descriptions and quantities of food to be given daily, at the present season, to a good dairy cow, weighing 12 cwt., and calved a month, in order to secure economically the best return of produce. With such feeding what would be the probable daily yield of milk, and weekly yield of butter?

7. What is the present current price per ton of the following feeding stuffs, and what is their manurial value when consumed by three-year-old feeding bullocks, namely, meadow-hay, wheat-straw, linseed, cotton-cake, bran, and wheat?

8. What proportion does the live weight bear to the dead weight of a lean three-year-old ox, a well fatted three-year-old ox, a half-bred sheep eighteen months old, a fifteen-score bacon pig, and a fat calf?

9. How are horses affected after greedily eating (1) unbruised wheat, (2) overheated hay, and (3) damp new beans? What frequently befalls impoverished young cattle liberally supplied with decorticated cotton-cake, and what is the usual effect of restricting cattle to straw and undecorticated cotton-cake? How do young rams suffer when forced with mangold and corn?

10. Describe the management of 200 half-bred lambs, from the period of weaning until they are sold in the following April, weighing from 20 lbs. to 24 lbs. per quarter. State the daily weight of roots, fodder, and concentrated food they will consume between Candlemas and Lady-day.

11. What vermin infest the skins of sheep? and describe how each description of vermin is to be got rid of.

12. Describe the nature of the following diseasos of plants, viz., smut in wheat, ergot of rye, finger-and-toes in turnips, and clover-dodder.

The vivâ voce *examination commences at* 2 *o'clock.*

EXAMINATION IN BOOK-KEEPING.

MAXIMUM NUMBER OF MARKS, 200. PASS NUMBER, 100.

Friday, April 16th, from 10 a.m. till 1 p.m.

Candidates are required to journalise and post by double entry the following transactions, and to make out a Trial Balance, Profit and Loss Account, and Balance Sheet:—

On the 1st of January, 1875, John Chiltern obtained a loan from his father, G. Chiltern, of 2000*l.* in cash, and purchased the business of R. Avon, a coal merchant, for which he paid him 1326*l.* in cash and accepted his draft due 4th April for 500*l.*

The Assets handed over by R. Avon consisted of—

	£	s.	d.
Coals, 500 tons	675	0	0
Coke, 180 chaldrons	81	0	0
Peat	20	0	0
Horses and Carts	475	0	0
Stable fittings, &c.	50	0	0
Office furniture	25	0	0
Goodwill	500	0	0
	£1826	0	0

The transactions for the month of January were as follows:—

					£	s.	d.
1st.	Sold for Cash, 40 tons Coal				66	0	0
3rd.	Sold to J. Griffiths on credit, 100 tons Coal				150	0	0
9th.	Sold for Cash, 70 tons Coal				115	8	0
12th.	Sold for Cash, 25 chaldrons Coke				15	0	0
18th.	Sold to J. Tod, 80 tons Coal				112	0	0
	J. Tod gave his acceptance due 7th April	£80	0	0			
	And Cash to balance	32	0	0			
					112	0	0
23rd.	Bought of the Eden Colliery Company, 400 tons Coal				520	0	0
	Accepted the Eden Colliery Company's draft due 9th April				520	0	0
24th.	Discounted J. Tod's acceptance and received in Cash	£78	16	0			
	There being deducted for discount	1	4	0			
					80	0	0
31st.	Paid Cash for Wages				9	10	0
	Paid for new office furniture				5	13	4
	John Chiltern drew out on private account				35	0	0

Stock on hand at the end of the month, viz.:—

	£	s.	d.
Coals, 610 tons	809	0	0
Coke, 155 chaldrons	69	15	0
Peat	20	0	0

EXAMINATION IN GEOLOGY.

Maximum Number of Marks, 100. Pass Number, 50.

Friday, April 16th, from 2 p.m. till 5 p.m.

1. Give the classification, distribution, and lithological characters of the stratified rocks in England.

2. Mention some of the characteristic fossils by which the great divisions of the stratified rocks may be distinguished.

3. Give the geological position and lithological and agricultural characters of the new red sandstone. Mention any useful substances obtained from this formation.

4. Explain the origin of clay. Define porcelain clay, fire clay, loam, brick-earth, and marl.

5. Upon what geological formations are the chief clay vales in England situated? Mention any points connected with their agricultural characters.

6. Contrast the geological and agricultural characters of the Wolds of Lincolnshire and Yorkshire with those of the Cotswold of Gloucestershire.

7. By what different agencies have rocks been altered in structure, arrangement, and composition? Give some examples.

8. Explain the meaning and origin of local, erratic, and alluvial soils, with examples.

9. Define the terms permeable and impermeable strata, and point out any influence they may have on the soils overlying them.

10. Name the specimens on the table, giving the approximate composition of the rocks and minerals, and the generic names and geological position of the fossils.

EXAMINATION IN BOTANY.

[It is expected that Eight Questions at least will be answered.]

Maximum Number of Marks, 100. Pass Number, 50.

Saturday, April 17th, from 10 a.m. till 1 p.m.

1. What are the contents of a growing vegetable cell?

2. Describe the composition of a fibro-vascular bundle in a dicotyledonous plant.

3. Name, and shortly describe the different kinds of roots; and explain the function of fleshy roots.

4. What is the nature and cause of the difference between grain and malt?

5. Explain the fall of the leaf.

6. What are the morphological differences between the fleshy organs of the following plants: turnip, potato, onion, kohl rabi, sweet potato, and crocus?

7. Give the plan of a typical flower, and explain the meaning of perfect, complete, regular, and symmetrical, as applied to the flower.

8. Explain the process of fertilization among angiosperms.

9. State the nature and development of the reproductive organs in fungi.

10. What are the reasons for having a rotation of crops?

11. Give the leading characters of one of the following Natural Orders: *Ranunculaceæ*, *Compositæ*, *Coniferæ*, or *Gramineæ*.

12. Describe in systematic method the plants marked A, B and C.

EXAMINATION IN ANATOMY AND ANIMAL PHYSIOLOGY.

Maximum Number of Marks, 100. Pass Number, 50.

Saturday, April 17th, from 2 p.m. till 5 p.m.

1. Describe the circulation of the blood, noting especially the differences in its condition in the so-called greater and lesser circulation. State also the leading anatomical peculiarities of arteries and veins.

2. What uses does the bile serve in the animal economy, and in what part of the system are these chiefly recognised?

3. When the functions of the liver are deranged are any of the excretory organs of the body brought into more active operation, if so, name the organs and the leading evidences of their excited action?

MEMORANDA.

ADDRESS OF LETTERS.—The Society's office being situated in the postal district designated by the letter W, members, in their correspondence with the Secretary, are requested to subjoin that letter to the usual address.

GENERAL MEETING in London, December, 1875.

GENERAL MEETING in London, May 22, 1876, at 12 o'clock.

MEETING at Birmingham, July, 1876.

MONTHLY COUNCIL (for transaction of business), at 12 o'clock on the first Wednesday in every month, excepting January, September, and October: open only to Members of Council and Governors of the Society.

ADJOURNMENTS.—The Council adjourn over Passion and Easter weeks, when those weeks do not include the first Wednesday of the month; from the first Wednesday in August to the first Wednesday in November; and from the first Wednesday in December to the first Wednesday in February.

OFFICE HOURS.—10 to 4. On Saturdays, from the Council Meeting in August until the Council Meeting in April, 10 to 2.

DISEASES of Cattle, Sheep, and Pigs.—Members have the privilege of applying to the Veterinary Committee of the Society, and of sending animals to the Royal Veterinary College on the same terms as if they were subscribers to the College.—(A statement of these privileges will be found in this Appendix.)

CHEMICAL ANALYSIS.—The privileges of Chemical Analysis enjoyed by Members of the Society will be found stated in this Appendix.

BOTANICAL PRIVILEGES.—The Botanical Privileges enjoyed by Members of the Society will be found stated in this Appendix.

SUBSCRIPTIONS.—1. Annual.—The subscription of a Governor is £5, and that of a Member £1, due in advance on the 1st of January of each year, and becoming in arrear if unpaid by the 1st of June. 2. For Life.—Governors may compound for their subscription for future years by paying at once the sum of £50, and Members by paying £10. Governors and Members who have paid their annual subscription for 20 years or upwards, and whose subscriptions are not in arrear, may compound for future annual subscriptions, that of the current year inclusive, by a single payment of £25 for a Governor, and £5 for a Member.

PAYMENTS.—Subscriptions may be paid to the Secretary, in the most direct and satisfactory manner either at the Office of the Society, No. 12, Hanover Square, London, W., or by means of post-office orders, to be obtained at any of the principal post-offices throughout the kingdom, and made payable to him at the Vere Street Office, London, W.; but any cheque on a banker's or any other house of business in London will be equally available, if made payable on demand. In obtaining post-office orders care should be taken to give the postmaster the correct initials and surname of the Secretary of the Society (H. M. Jenkins), otherwise the payment will be refused to him at the post-office on which such order has been obtained; and when remitting the money-orders it should be stated by whom, and on whose account, they are sent. Cheques should be made payable as drafts on demand (not as bills only payable after sight or a certain number of days after date), and should be drawn on a London (not on a local country) banker. When payment is made to the London and Westminster Bank, St. James's Square Branch, as the bankers of the Society, it will be desirable that the Secretary should be advised by letter of such payment, in order that the entry in the banker's book may be at once identified, and the amount posted to the credit of the proper party. No coin can be remitted by post, unless the letter be registered.

NEW MEMBERS.—Every candidate for admission into the Society must be proposed by a Member; the proposer to specify in writing the full name, usual place of residence, and post-town, of the candidate, either at a Council meeting, or by letter addressed to the Secretary. Forms of Proposal may be obtained on application to the Secretary.

⁎ Members may obtain on application to the Secretary copies of an Abstract of the Charter and Bye-laws, of a Statement of the General Objects, &c., of the Society, of Chemical, Botanical, and Veterinary Privileges, and of other printed papers connected with special departments of the Society's business.

Members' Veterinary Privileges.

I.—Serious or Extensive Diseases.

No. 1. Any Member of the Society who may desire professional attendance and special advice in cases of serious or extensive disease among his cattle, sheep, or pigs, and will address a letter to the Secretary, will, by return of post, receive a reply stating whether it be considered necessary that Professor Simonds, the Society's Veterinary Inspector, should visit the place where the disease prevails.

No. 2. The remuneration of the Inspector will be 2*l.* 2*s.* each day as a professional fee, and 1*l.* 1*s.* each day for personal expenses; and he will also be allowed to charge the cost of travelling to and from the locality where his services may have been required. The fees will be paid by the Society, but the travelling expenses will be a charge against the applicant. This charge may, however, be reduced or remitted altogether at the discretion of the Council, on such step being recommended to them by the Veterinary Committee.

No. 3. The Inspector, on his return from visiting the diseased stock, will report to the Committee, in writing, the results of his observations and proceedings, which Report will be laid before the Council.

No. 4. When contingencies arise to prevent a personal discharge of the duties confided to the Inspector, he may, subject to the approval of the Committee, name some competent professional person to act in his stead, who shall receive the same rates of remuneration.

II.—Ordinary or Other Cases of Disease.

Members may obtain the attendance of the Veterinary Inspector on any case of disease by paying the cost of his visit, which will be at the following rate, viz., 2*l.* 2*s.* per diem, and travelling expenses.

III.—Consultations without Visit.

Personal consultation with Veterinary Inspector	5*s.*
Consultation by letter	5*s.*
Consultation necessitating the writing of three or more letters	10*s.*
Post-mortem examination, and report thereon	10*s.*

A return of the number of applications during each half-year being required from the Veterinary Inspector.

IV.—Admission of Diseased Animals to the Veterinary College; Investigations; Lectures, and Reports.

No. 1. All Members of the Society have the privilege of sending cattle, sheep, and pigs to the Infirmary of the Royal Veterinary College, on the same terms as if they were Members of the College; viz., by paying for the keep and treatment of cattle 10*s.* 6*d.* per week each animal, and for sheep and pigs "a small proportionate charge to be fixed by the Principal according to circumstances."

No. 2. The College has also undertaken to investigate such particular classes of disease, or special subjects connected with the application of the Veterinary art to cattle, sheep, and pigs, as may be directed by the Council.

No. 3. In addition to the increased number of lectures now given by Professor Simonds—the Lecturer on Cattle Pathology—to the pupils in the Royal Veterinary College, he will also deliver such lectures before the Members of the Society, at their house in Hanover Square, as the Council shall decide.

No. 4. The Royal Veterinary College will authorize their Principal to furnish to the Council quarterly a detailed Report of the cases of cattle, sheep, and pigs treated in the Infirmary; and also special reports from time to time on any matter of unusual interest which may come under the notice of the College.

By Order of the Council,

H. M. JENKINS, *Secretary.*

Members' Privileges of Chemical Analysis.

The Council have fixed the following rates of Charge for Analyses to be made by the Consulting Chemist for the *boná fide* use of Members of the Society; who (to avoid all unnecessary correspondence) are particularly requested, when applying to him, to mention the kind of analysis they require, and to quote its number in the subjoined schedule. The charge for analysis, together with the carriage of the specimens, must be paid to him by members at the time of their application.

No. 1.—An opinion of the genuineness of Peruvian guano, bone-dust, or oil-cake (each sample)	5s.
„ 2.—An analysis of guano; showing the proportion of moisture, organic matter, sand, phosphate of lime, alkaline salts, and ammonia	10s.
„ 3.—An estimate of the value (relatively to the average of samples in the market) of sulphate and muriate of ammonia, and of the nitrates of potash and soda	10s.
„ 4.—An analysis of superphosphate of lime for soluble phosphates only	10s.
„ 5.—An analysis of superphosphate of lime, showing the proportions of moisture, organic matter, sand, soluble and insoluble phosphates, sulphate of lime, and ammonia ..	£1.
„ 6.—An analysis (sufficient for the determination of its agricultural value) of any ordinary artificial manure	£1.
„ 7.—Limestone:—the proportion of lime, 7*s.* 6*d.*; the proportion of magnesia, 10*s.*; the proportion of lime and magnesia	15s.
„ 8.—Limestone or marls, including carbonate, phosphate, and sulphate of lime, and magnesia with sand and clay ..	£1.
„ 9.—Partial analysis of a soil, including determinations of clay, sand, organic matter, and carbonate of lime	£1.
„ 10.—Complete analysis of a soil	£3.
„ 11.—An analysis of oil-cake, or other substance used for feeding purposes; showing the proportion of moisture, oil, mineral matter, albuminous matter, and woody fibre; as well as of starch, gum, and sugar, in the aggregate	£1.
„ 12.—Analyses of any vegetable product	£1.
„ 13.—Analyses of animal products, refuse substances used for manure, &c.	from 10s. to 30s.
„ 14.—Determination of the "hardness" of a sample of water before and after boiling	10s.
„ 15.—Analysis of water of land drainage, and of water used for irrigation	£2.
„ 16.—Determination of nitric acid in a sample of water	£1.

N.B.—*The above Scale of Charges is not applicable to the case of persons commercially engaged in the Manufacture or Sale of any Substance sent for Analysis.*

The Address of the Consulting Chemist of the Society is, Dr. Augustus Voelcker, F.R.S., 11, Salisbury Square, London, E.C., to which he requests that all letters and parcels (Postage and Carriage paid) should be directed.

By Order of the Council,

H. M. JENKINS, *Secretary.*

INSTRUCTIONS FOR SELECTING AND SENDING SAMPLES FOR ANALYSIS.

ARTIFICIAL MANURES.—Take a large handful of the manure from three or four bags, mix the whole on a large sheet of paper, breaking down with the hand any lumps present, and fold up in tinfoil, or in oil silk, about 3 oz. of the well-mixed sample, and send it to 11, SALISBURY SQUARE, FLEET STREET, E.C., by post: or place the mixed manure in a small wooden or tin box, which may be tied by string, but must not be sealed, and send it by post. If the manure be very wet and lumpy, a larger boxful, weighing from 10 to 12 oz., should be sent either by post or railway.

Samples not exceeding 4 oz. in weight may be sent by post, by attaching two penny postage stamps to the parcel.

Samples not exceeding 8 oz., for three postage stamps.

Samples not exceeding 12 oz., for four postage stamps.

The parcels should be addressed: DR. AUGUSTUS VOELCKER, 11, SALISBURY SQUARE, FLEET STREET, LONDON, E.C., and the address of the sender or the number or mark of the article be stated on parcels.

The samples may be sent in covers, or in boxes, bags of linen or other materials. No parcel sent by post must exceed 12 oz. in weight, 1 foot 6 inches in length, 9 inches in width, and 6 inches in depth.

SOILS.—Have a wooden box made 6 inches long and wide, and from 9 to 12 inches deep, according to the depth of soil and subsoil of the field. Mark out in the field a space of about 12 inches square; dig round in a slanting direction a trench, so as to leave undisturbed a block of soil with its subsoil from 9 to 12 inches deep; trim this block or plan of the field to make it fit into the wooden box, invert the open box over it, press down firmly, then pass a spade under the box and lift it up, gently turn over the box, nail on the lid and send it by goods or parcel to the laboratory. The soil will then be received in the exact position in which it is found in the field.

In the case of very light, sandy, and porous soils, the wooden box may be at once inverted over the soil and forced down by pressure, and then dug out.

WATERS.—Two gallons of water are required for analysis. The water, if possible, should be sent in glass-stoppered Winchester half-gallon bottles, which are readily obtained in any chemist and druggist's shop. If Winchester bottles cannot be procured, the water may be sent in perfectly clean new stoneware spirit-jars surrounded by wickerwork. For the determination of the degree of hardness before and after boiling, only one quart wine-bottle full of water is required.

LIMESTONES, MARLS, IRONSTONES, AND OTHER MINERALS.—Whole pieces, weighing from 3 to 4 oz., should be sent enclosed in small linen bags, or wrapped in paper. Postage 2*d*., if under 4 oz.

OILCAKES.—Take a sample from the middle of the cake. To this end break a whole cake into two. Then break off a piece from the end where the two halves were joined together, and wrap it in paper, leaving the ends open, and send parcel by post. The piece should weigh from 10 to 12 oz. Postage, 4*d*. If sent by railway, one quarter or half a cake should be forwarded.

FEEDING MEALS.—About 3 oz. will be sufficient for analysis. Enclose the meal in a small linen bag. Send it by post.

On forwarding samples, separate letters should be sent to the laboratory, specifying the natnre of the information required, and, if possible, the object in view.

H. M. JENKINS, *Secretary*.

Members' Botanical Privileges.

The Council have provisionally fixed the following Rates of Charge for the examination of Plants and Seeds for the *bonâ fide* use of Members of the Society, who are particularly requested, when applying to the Consulting Botanist, to mention the kind of examination they require, and to quote its number in the subjoined Schedule. The charge for examination must be paid to the Consulting Botanist at the time of application, and the carriage of all parcels must be prepaid

No. 1.—A general opinion as to the genuineness and age of a sample of clover-seed (each sample) .. .. .. 5*s.*

„ 2.—A detailed examination of a sample of dirty or impure clover-seed, with a report on its admixture with seeds of dodder or other weeds (each sample) .. .. .. 10*s.*

„ 3.—A test examination of turnip or other cruciferous seed, with a report on its germinating power, or its adulteration with 000 seed (each sample) .. .. .. 10*s.*

„ 4.—A test examination of any other kind of seed, or corn, with a report on its germinating power (each sample) .. 10*s.*

„ 5.—Determination of the species of any indigenous British plant (not parasitic), with a report on its habits (each species) .. .. 5*s.*

„ 6.—Determination of the species of any epiphyte or vegetable parasite, on any farm-crop grown by the Member, with a report on its habits, and suggestions (where possible) as to its extermination or prevention (each species) .. 10*s.*

„ 7.—Report on any other form of plant-disease not caused by insects .. .. 10*s.*

„ 8.—Determination of the species of a collection of natural grasses indigenous to any district on one kind of soil (each collection) .. .. 10*s.*"

INSTRUCTIONS FOR SELECTING AND SENDING SAMPLES.

In sending seed or corn for examination the utmost care must be taken to secure a fair and honest sample. If anything supposed to be injurious or useless exists in the corn or seed, selected samples should also be sent.

In collecting specimens of plants, the whole plant should be taken up, and the earth shaken from the roots. If possible, the plants must be in flower or fruit. They should be packed in a light box, or in a firm paper parcel.

Specimens of diseased plants or of parasites should be forwarded as fresh as possible. Place them in a bottle, or pack them in tin-foil or oil-silk.

All specimens should be accompanied with a letter specifying the nature of the information required, and stating any local circumstances (soil, situation, &c.) which, in the opinion of the sender, would be likely to throw light on the inquiry.

N.B.—*The above Scale of Charges is not applicable in the case of Seedsmen requiring the services of the Consulting Botanist.*

Parcels or letters (Carriage or Postage prepaid) to be addressed to Mr. W. Carruthers, F.R.S., 4, Woodside Villas, Gipsy Hill, S.E.

H. M. JENKINS, *Secretary.*

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